

Aviation Week

and Space Technology

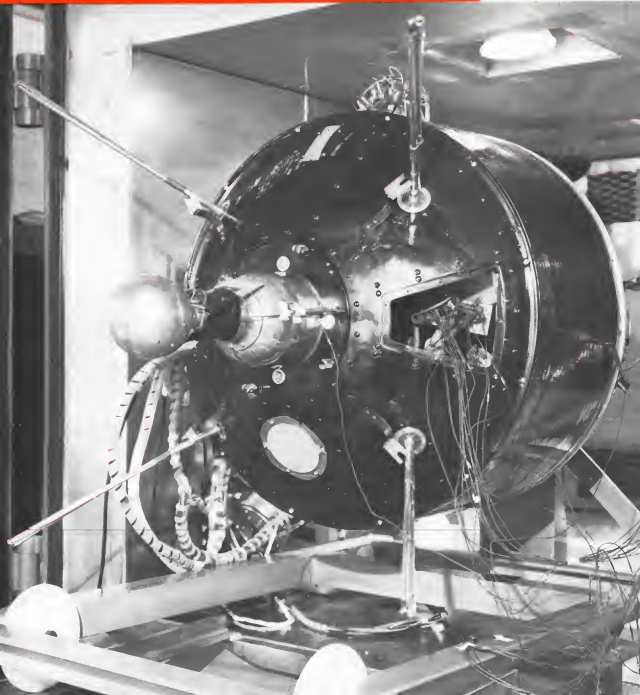
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November 6, 1961

**NASA Studies
Astronaut's Role
In Rendezvous**

**U.S.-British Electron
Measurement Satellite**



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AEROSPACE CALENDAR

Nov 13 14—Electricity Explored: We
Conference, Kewauit Hotel, Boston.
Miss Sprague Thermal Radiation Lab
meeting. Geophysical Research Directorate,
AF Cambridge Research Laboratories

Nov. 13-15—Conference on Vaguetics and Vaguetic Methods, Institute of Radio Engineers, Hotel Greenwood Inn, Phoenix
Nov. 14—Symposium on Electronic Systems Reliability, IBM, Kansas City, Mo.

Nov. 14-16—Northwest Electronics Research and Engineering Meeting, Institute of Radio Engineers, Commonwealth Armory and Somerset Hotel, Boston, Mass.

May 18 (L24074) Annual Aerospace Electric Society Display, Van Nuys Auditorium, Los Angeles, Calif.
May 18-19, 1974, Sacramento, or Reno, Nev.

1942-1943, in Department of the Space Sciences, University of California at Los Angeles, Los Angeles, Calif. Sponsor: Frank Kennedy (1942-1943), UCLA; Air Force Office of Science

Nov. 1974—Medical and Biological Problems in Space Flight Conference, NASA, Silverton.

Nov. 27-Dec. 1—Army Institute, Aviation Logistics Symposium, Campa Hotel, St. Louis, Mo.
Nov. 28-Mar-88 Meeting, Aviation District

Nov. 30-Dec. 1—1975 National Conference
University of Radio Engineers' Electronics

Group on Violence Communication
Rafael Ertel, Minneapolis, Minn.
(Continued on page 6)

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November 4, 1961

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AIRCRAFT ENGINE DIVISION . . . MUSKOGEE MICHIGAN

(Continued from page 5)

- Dec. 4—Ballistics Meeting, Conference, New York University, Washington Square Center, New York, N. Y.
- Dec. 5—13th Annual Meeting, National Air Traffic Conference, Statler Hilton Hotel, Washington, D. C.
- Dec. 5-7—United Communications National Association, Trade Area, Statler Hilton Hotel, Washington, D. C.
- Dec. 12-14—Future Joint Computer Conference, Shattuck Park Hotel, Washington, D. C.
- Dec. 18-1989—Weight Builders Lecture, National History Bldg., Smithsonian Institution, Washington, D. C.
- Jan. 9-11—Eightth National Symposium on Reliability and Quality Control, Statler Hilton Hotel, Washington, D. C.
- Jan. 15-17—Symposium on Optical Character Recognition, Department of the Interior, Smithsonian Institution, Washington, D. C. Sponsored by Information Systems Research Office of Naval Research and Research Administration Contract/National Bureau of Standards.
- Jan. 22-24—13th Annual Meeting, Inst. of the Aerospace Sciences, Hotel Astor, New York, N. Y. Hours: 8:00 AM-5:00 PM.
- Jan. 25-26—Third Annual Solid Propellant Rocket Conference, American Rocket Society, Radio University, West York.
- Jan. 24-26—Second Symposium on Thermophysical Properties, Princeton, N. J. Sponsored by Fluid Properties Division, American Society of Mechanical Engineers.
- Feb. 5-7—Symposium on Automobiles, Tech. Support for Computing Systems, Department of the Interior, Smithsonian Institution, D. C. Sponsored by Information Systems Research Office of Naval Research.
- Feb. 7-8—Third Winter Conference on Military Electronics, IRE, Ambassador Hotel, Los Angeles.
- Feb. 14-16—International Solid State Circuits Conference, Institute of Radio Engineers, Sheraton Hotel and University of Pennsylvania, Philadelphia, Pa.
- Feb. 15—After Symposium on the Application of Statistical Theory in Space Technology, Palo Alto, Calif. Sponsored by Lockheed Aircraft Corp., Air Force Office of Scientific Research.
- Mar. 1-3—Fifth Biotechnology and Biomaterials Conference, Department of Radio Frequency, Statler Hilton Hotel, Washington, D. C.
- Mar. 5-6—Sixth Annual Gas Turbine Conference and Products Show, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- Mar. 15-16—Solidity of the Airframe Structure, 1989 Symposium, Meeting, John F. Kennedy Club, Cleveland, Ohio.
- Mar. 14-16—Electric Propulsion Conference, American Rocket Society, U. S. Naval Postgraduate School, Monterey, Calif.
- Mar. 16-18—International Conference in Solid State Reliability, Columbia and United Nations Bldg., New York, N. Y.
- Apr. 1-4—1989 Year Conference, Airport Operators Council, Sheraton Hotel, Washington, D. C.
- Apr. 14-16—Laser Video Structures and Materials Conference, American Rocket Society, Astoria, Bldg., Phoenix, Ariz.



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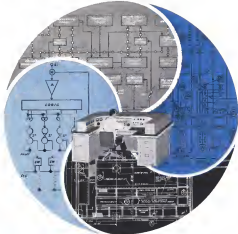
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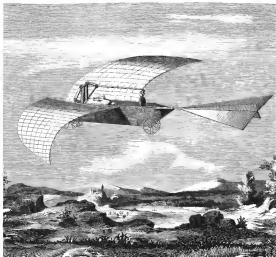
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November 4, 1961

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Vol. 31, No. 19
November 4/11 and 18/19

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EDITORIAL

A Dismal Pattern

The decision by Secretary of Defense Robert S. McNamara to withhold the \$750 million voted in Congress for additional long-range bombers, as acquired and expanded B-70 development programs and as a celebrated Deane-Sore program is another chapter in a familiar dismal pattern that has haunted the U.S. defense effort for more than a decade.

This pattern has involved an almost perpetual conflict between the legislative and executive branches of the government over how much defense strength is really required to support the U.S. position in the international arena. This conflict has generated repeatedly such political jockeying as to control or either branch of the government. It has also resulted in the Congress pushing larger defense appropriations than the executive branch has requested, with those increases almost invariably for strengthening the strategic nuclear forces and new weapons development in areas where Congress believed the executive branch skimped before the levels of safety.

In taking this action to withhold the \$750 million to fund budget boost voted by Congress, Mr. McNamara is playing himself in the same pattern followed by three of the last effective secretaries of defense in the history of this post-war department.

This pattern first emerged in the fall of 1949 when the Democratic executive branch, with Harry S. Truman as president and Louis Johnson as defense secretary, impounded about \$300 million in extra defense funds voted by a Republican-controlled Congress to increase the Air Force from 45 to 70 combat groups. This congressional action was led by the late Republican Senator Robert Taft. Less than a year after the Truman-Johnson action the Communists invaded South Korea. The defense budget was soon then doubled to fight the Korean war and the Air Force was increased to over 100 combat groups and Mr. Johnson left the Pentagon under forced duress.

Then again in the summer of 1956 a Democratic Congress, spurred by growing indications of Soviet technical progress in jet aircraft and missiles, voted some \$300 million more for accelerating and expanding the B-52 long-range bomber and KC-119 jet tanker fleet and the ICBM and anti-ICBM development programs. This move was opposed by Republican President Eisenhower and his defense secretary, the late Charles E. Wilson. A year later, in the summer of 1957, Mr. Wilson, with the support of President Eisenhower, was still concerned with pushing the defense budget downward with virtually imposed dollar ceilings on each service. This was just a few months before Sputnik I provided the first public proof of the Soviet capability in space technology and about the same time that the Soviets were firing their initial ICBM over their Siberian test range.

In 1958 a Democratic Congress initially boosted the Eisenhower Fiscal 1959 defense budget by some \$350 million for strategic weapons such as Minuteman and Polaris missiles, strategic airlift and Hound Dog missiles for the B-52. In the final Defense Department President Eisenhower and his new defense secretary, Neil McMillen, rejected their request. Congress had voted

\$1.3 billion more than the Administration was willing to use.

Now in 1961, a Democratic President John F. Kennedy and his defense secretary, McNamara, have followed a similar pattern in dealing with the actions of a Democratic-controlled Congress. Although Mr. McNamara has been stubbornly resistant to his opposition to congressional funding of his defense budget for bombers, it is interesting to note that the final decision to suspend the \$750 million extra voted by Congress was deferred until Congress adjourned for the summer and its leaders in the fight were scattered to their home states. It is also interesting to note that this congressional action was made not only against the strong desire of Congress but also against the advice of the military leaders who have the responsibility for successfully employing these strategic nuclear delivery forces against an enemy, if necessary. This too follows the familiar pattern begun by Louis Johnson and Harry Truman.

There is another element of this pattern that should be studied carefully. It is apparent from their actions during the administration of that pattern that the leaders of the Soviet Union place far more emphasis on what the leaders of the country do about our defense than on the public speeches they may make on its excellence and adequacy. The "rat the fat but not the mouth" policy of Truman and Johnson was followed of death in its aftermath of armed Communist aggression in Korea.

The pathetic concern of the Eisenhower Administration with holding defense budget ceilings, when a technological revolution in aerospace, missiles and space technology was unfolding underneath it, certainly was reflected in the astonishing, tough Soviet line that has resulted a crisis—let's continue not a climax, is the current Berlin situation.

It may be equally hard for the Soviet leaders to be concerned of this nation's determination to continue to stand for what it believes to be right, even in the face of the risk of war, if our leaders can still squabble over \$750 million in the critical area of strategic aerospace power with one branch of state.

The measurable marks of history, has proved, in retrospect, that Congress has made far worse decisions on defense policy and weapons strength than have the President defense secretary combinations in both Democratic and Republican administrations. In fact the defense budget decisions of Wilson, Johnson, Wilson and McNamara have proved to be expensive errors. This may be due in part to the fact that congressional leaders on defense issues have for the most part had long years of experience in this field, while each new defense secretary comes fresh to the work with little or no experience in military affairs and charged with a mission by his President to "save money" and show the Pentagon who is really boss.

Now Mr. McNamara has made his decision, with President Kennedy's promise of not public support to follow the pattern of his predecessors. Therein alone will prove the wisdom or error of his choice.

—Robert Blatz

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FINAL CLEAN-UP BEFORE PUMPDOWN: The stainless-steel interior of the Bendix high vacuum chamber is being cleaned, polished and wiped down with swabs in preparation for robot assembly this fall. This 30" by 27" chamber, the heart of the Bendix Space Laboratories, will soon simulate a habitat of over a million feet. The technician is putting finishing touches on the 10 ton head which slides aside to allow positioning of full size satellites and space capsules. Sixteen quartz lenses mounted in the head will introduce solar radiation. The rods at the side will hold plates through which liquid nitrogen is pumped to simulate the chill of space darkness.

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Washington Roundup

USAF Space Stand

The studied Air Force position on space evolved by Chief of Staff Gen. Curtis LeMay has been presented and was presented last week to top Defense Department executives, including Secretary Robert McNamara. The study, prepared after extensive polling and lasting within the service (AW Sept. 21, p. 21), is in the form of a document envisioning what Air Force thinks it could do in space over the next 10 years.

Completion of the study comes amid an increasing clamor for a larger space role for the service, but several influential members of Congress are wary of any plans that might expand the military role of the service of the National Aeronautics and Space Administration. Chairman George F. Miller of the House Science and Astronautics Committee, for example, is keeping a close watch on the multi-epoch space situation and says he will fight any encroachment on NASA's territory. He intends to press for more emphasis on air-on ground applications of space technology. The division of responsibilities between the service and the civilian agency is expected to become a major debating topic in Congress next year.

Intelligence Fiddling

Air Force technical intelligence, bolstered by some of the gaps in its technical knowledge that were revealed by the Soviet Union's air show at Tushino last July (AW July 17, p. 36), has been fiddling with the code names assigned to new Russian aircraft in a makeshift attempt to correct the gaps. The new Mach 2.4 Yakovlev fighter design, which had been called the "Portuguese devil" looks in the Bendix and identified as a bomber was closely identified at Tushino to be an extremely long-range interceptor armed with anti-air missiles. To cover that area, USAF has now outlined its new fleet of fighters to include interceptors putting it into the proper fighter-interceptor category.

USAF finally code-named the new Mach 2 two-seat bomber, on which it had not had information previously, the "Bomber" and then quickly corrected that name because of the obvious possibilities for topographical error. In the interval when the bomber had no official code name, Avianova Wings defined it as being because of its excellent aerodynamic design, and that designation soon is widely used. But USAF took the Bendix code name that it had acquired from the Yakovlev interceptors and quickly applied it to the "Bomber" in an attempt to prevent the fiction that the Bendix name is too vague, it is already wrong that it had carried the Bendix code name on its roster for some years.

NASA Life Sciences

Work for NASA to pursue its own biotechnology program regardless of the recommendations made by the various groups now studying the problem. NASA already has demonstrated its life sciences program within the framework of its latest reorganization and plans to assign specific teams to tackle specific problems, drawing on civilian resources and military resources and personnel as well as its own cadres. Heads of their task forces won't necessarily be NASA personnel.

Senior functions of several executive departments of the government have given the point that President Kennedy is considering creating assistant secretaries for science. Dismissed on establishing such a post within the Executive Department, which includes the Weather Bureau, the National Bureau of Standards and the Coast and Geodetic Survey, are well along. Other departments likely to have science secretaries—Agriculture, Interior and Health, Education and Welfare.

Western Europe's annual investment in air transportation will grow from 1956-60 average of \$180 million to \$200 billion by 1970, an increase of 67%, according to estimates in the Transport Canada Funds recently published study, "Europe's Needs and Resources."

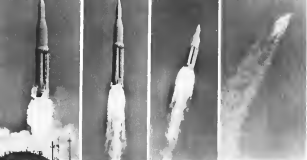
Brown's New Role

Recent speech of Dr. Harold Brown, defense director of research and engineering, at the Naval Research Laboratory (AW Oct. 12, p. 26) was the beginning of a program to make some active appearance. Brown, who is 34, has been forward and has been critical by all political parties in the Pentagon but is catching on rapidly. He believes that the old effectiveness approach to weapon design is causing some confusion and that technical considerations are being given too little emphasis.

In spite of Secretary McNamara's comment that Dyna-Soc is still undergoing reorganization (see p. 28), Pentagon officials expect no short cuts or major changes now that the extra funds voted by Congress have been expended.

With the Portuguese continually tightening the lid on public information, visitors these days are being greeted with the question "Are you cleared for information?"

—Washington Staff



FOUR PHOTO SEQUENCE of Saturn launch shows from left to right: (1) rocket leaving its launching pad; (2) Saturn going west on its barge; (3) moving north on its MLP; (4) flight down the Atlantic Missile Range; (5) rotating upper stage as it powers up its engines. Saturn was launched from Cape Canaveral, Fla., Oct. 17.

Telemetry Data Confirms Saturn Success

By George Alexander

Cape Canaveral—Detailed analysis of flight data from S10 on-board telemetry channels has confirmed that the Saturn booster, which will lift Apollo configurations and vehicles in earth orbit, made a flawless first flight.

Saturn S8-1 was launched Oct. 27 and a lifetime analysis of flight data was completed Oct. 31 at NASA's Aeronautics and Space Administration's Marshall Space Flight Center, Huntsville, Ala.

An Apollo hardware configuration is to be launched in the period of the seventh Saturn development flight, a 1965. After acceleration on this schedule depends on development of the S1V second stage, called the paving idea by Dr. Wernher von Braun, Marshall's director. The S1V stage is proposed in a cluster of six pairs of Whitey LR-115 hydrogen engines, engines which have been delayed in development (A&E Oct. 21, p. 20).

Both NASA and Pratt & Whitney fuel LR-115 problems have been over come and the engine recently had a run of seven consecutive successful tests (p. 15). The engine is to be used on both Saturn and Centaur propulsion, and will enable its first flight as a Centaur stage in January.

Saturn S8-1, with water-fueled S1V and a combustible V5A pad, was capped with a Jupiter nose cone

Flight analysis shows it flew 234,777 mi and reached a peak altitude of 54,515 mi. During the last seconds of powered flight, a full oxidation of 14 cps developed from fuel dosing but the weight, remained low enough so that the ballistic trajectory was not affected.

Lifted was at 10:06:01 a.m. EST after an 11-lb. coast during which there were two half-sec. for further testing of the. No technical difficulties were encountered during the road.

The right Rocketdyne thrust 11-1 engine was in the Atlas Thor and Jupiter nose propulsion, were stored in opening from 100 millionths start-offload engines 5 and 7. But, two outflows 6 and 8, 10, 11, 12 and 4 and 11, 12, 13, 14, 15 and 16. Lifted thrust, 1.5 million tons, was held, then 3.24 million lb. a thrust, less than the anticipated 1.5 million lb. Micro-thrust, achieved just prior to burn out, was 1.515 million lb.

Thrust Frame Flow

An full thrust developed in 1.4 sec., the thrust frame of the propellant flared about 1 in., allowing four support arms to be retracted from the booster base. First remaining arm and held the booster for 3.97 sec. in the automatic ground electronic equipment made fuel checks for single combustion in the engines and pump tank and hydrocarbon pressure. The liquid oxygen

and hydrogen, while 89 mm were carried from the booster base, the high-velocity in the returning area were reduced and the vehicle continued to launch. Lifted weight of the 161 lb. full S8-1 was 927,000 lb.

Launched on a smooth of 100 deg., the S8-1 began to pitch out gradually on its down range trajectory 10 sec after liftoff. Programming continued until T+130 sec., when the vehicle was in flight 81 deg. to the launch vertical. Maximum dynamic pressure occurred at T+60 sec. at an altitude of 40,000 ft. and at 7.5 sec. Dr. Kent H. Deeken, launch operations director, had and earlier that of the vehicle successfully reached that point in the flight profile, he would consider the flight to be a "100% success." Another Marshall Space Flight Center official said that the, "the engine, even 'load out' when S8-1 passed through this critical area."

Tracking data from the also high frequency doppler radar indicated that the upward engines shut down after 190.77 sec. flight time and the outboard at 111.17 sec., both about 2 sec. shorter than programmed but well within allowances for the first flight test. Shut down of the eight engines at 75 sec. altitude and 79 sec. downrange—a staggered to preclude confusion that eight were from about three terminations and to permit easy complete utilization of fuel.

Total flight time was 493.6 sec., peak

velocity was 5,607 mph, and the entire vehicle was stage of which was ignited, impacted within 7 mi. of the target area approximately 70 mi. north of Little Alaco Island. Chase aircraft used to monitor and photograph the vehicle's flight included a Lockheed C-130 at 25,000 ft., a Douglas A1D-1 at about 40,000 ft. and Lockheed U-2 (A&E Oct. 10, p. 15) aircraft.

Countdown Procedure

The count began at 11 p.m. the night before launch at T-600 min. At T-578 min., vehicle power was turned on to examine electrical circuits and components and at T-518 min., 40,000 lb. of liquid oxygen were pumped about the center 395 in. the tank and four of the eight outboard 70 in. dia. tanks for leakage checks and to cool tanks, valves and tanks.

At T-578 min., the stabilized platform on the Saturn's guidance system was activated to check roll and yaw commands and at T-268 min., the vehicle began to roll on internal power to check the flight hardware.

The 118 ft. x 118 ft. aerator structure, with a 56 ft. wide slot to accommodate the Saturn vehicle, was rolled back at T-420 min. to a point some 500 ft. from the launch pedestal. The launch area was cleared of all personnel at T-80 min. and the vehicle filled with liquid oxygen from T-60 to T-10 min. Fuel, 30-1, was loaded about the four outboard tanks two days earlier.

The telemetry receiver went on at T-174 sec., a half minute 10 a.m. EST. Monitoring tank, hydrocarbon and pump pressures and the performance of other sensors, the sequencer command a continuous page of the engine temperature at T-300 sec. and closed the vents of the five liquid oxygen tanks at T-120 sec. Struts switched down external to external power at T-35 sec.—a point at an instant at which the vehicle must either be successfully launched or the flight ended—and, at T-25 sec., the sequencer commanded ejection of the 700-lb. ejection cones needed to the interstage section between the booster and upper S1V stage, where the guidance system, telemetry, programming, transmission and command control packages were housed.

At T-00, the sequencer ordered the firing of a single solid propellant charge and the gas pressure brought the buoyancy of each engine up to speed. Hydrocarbon valves were then opened and fuel and oxidizer were introduced into the combustion chamber more liberally so that the liquid gas in propellant tanks with the liquid oxygen. The sequencer flame ignited the RP-1.

Potential problems area proved to be less serious than Marshall Space Flight Center personnel anticipated.

• Noise. A wave of about 50 sound read-

ings were taken at and around the launch complex at other points on Cape Canaveral on Merritt Island (between the Cape and the Florida mainland) and at various locations on the river bank up to a distance of about 100 mi. from the launch complex. NASA expected about 115 db. of a divergence of 2 mi. from the launch stand, 100 db. at the Green Beach entrance, which connects the beach to the mainland, and about 95 db. in Titmouse, north of the Cape on the mainland. NASA press releases stressed the point that these levels were well within the tolerance of the human ear and heard them to the sound of a machine of power, noise, police car horns and "the rumble of distant thunder." Nonetheless at a press site 11,000 ft. from the pad were in general agreement that the noise was less than they had expected and some felt that it was less than caused by some Atlas and Titan launches. The measurements were made in Marshall Space Flight Center, the Air Force Missile Test Center, the USAF Aeronautics Systems Division's environmental service team and the U.S. Coast and Geodetic Service, the last stationed evaluating ground vibration tests. Preliminary analysis had not indicated that actual sound levels were lower than those predicted.

• Flooding on the booster base. To protect critical engine components, such as the pumps, valves, control devices and instrumentation, against the 4,500-g. column, Marshall Center personnel devised a double heat shield through which the heat seals of the eight engines protruded. Basically a glass fiber fabric with a silicon rubber, a silver foil and a reflective coating, the surface was designed to take up to 10,000 ft. of heat without burning. Between the curtain and the booster base, NASA installed a plastic heat shield which was partially attached and could completely absorb the heat of the eight engines. Over the heat shield, an aluminum glass fiber cloth tape was used to reduce radiant heat on the Saturn base below the insulation breather panel.

After launch, the tape shield was attached all structural members for the remainder of the flight. Rocketdyne analysis indicated that a preliminary erosion of the heating data indicated that the booster during flight showed that temperatures did not exceed anticipated levels and that all insulation stayed up well.

• Rough combustion and engine vibration. Both NASA and Rocketdyne were concerned with the possibility of rough combustion in the H-1 engines, a condition caused by acoustics within the thrust chamber which results in the flame front moving back and forth in front of the injector plate and occasionally striking the plate. Destructive



SATURN, 162.8 high, made a 493.6 sec. successful flight down Atlantic Missile Range.

failures are not only possible in rough combustion engines, but if not caught quickly and the engine properly shut down—more than possible. Rocketdyne officials declined to reveal what steps are being taken to correct this problem, but Ronald K. Davis, Reg., Marshall Space Flight Center, in a report presented to the recent American Rocket Society meeting in New York, said that special H-1 engines were modified by the introduction of an improved turndown and a "new injector to reduce rough combustion tendencies at the higher thrust levels." The updated H-1 engines, which will have an

Europeans Plan Space Launcher Activities

London—Delegates from nine nations interested in the commercial use of space met in closed sessions here last week to discuss joint proposals for a European launcher development program.

Austria declined to participate, although Norman Sweden and Sweden last week announced elsewhere (AW Oct. 8, p. 27). Austria has a design team, and launchers probably will be made at the Woomera rocket test range.

The meeting was an outgrowth of the Seabasing conferences earlier this year (AW Jan. 23, p. 36) and has been accordingly guided by Britain and France, despite apathy and resistance in smaller nations. Sweden for one, thinks it should have been allowed to submit a proposal for a launcher third stage, which will be built in West Germany.

The European space plan, based on the de Havilland Harrier Stratos in first stage and Puma's Venesque in second (AW Feb. 10, p. 25), calls for both specific arms, other than an agreed subject in a communications satellite. The primary task, according to Minister of Atomic Power Thomassen's joint text with France's Minister of Atomic Power, Francois de Brois, is to prepare the launcher plan "at the earliest possible date." Development cost is \$280 million, at which Britain will provide a third.

Rep. Miller to Press For U.S. Hover Craft

Washington—House Science and Astronautics Committee next year will push for more U.S. emphasis on development of ground effect machines capable of carrying passengers and cargo over land and water.

Committee Chairman George F. Miller (D-Calif.) told Astronautics Week last week that studies of hovercraft were in the field during his recent European tour but criticized him with "vehement" which are supported by a cabinet of "no-need" "institutions" on transportation issues.

Rep. Miller and the U.S. lagged in developing land-based craft and must not let the same thing happen with ground effect machines, at least not. Although the committee's 1982 agenda has not been drafted, the chairman's interest is expected to lead to early legislation on U.S. progress in the hovercraft field.

Great Britain has been placing heavy stress on hover craft in recent years. Jonathan P. M. Heron, Washington representative of Britain's government-

sponsored National Research Development Corp., said he believes the British are "one or two years ahead of the U.S." in the field. He and Saunders-Roe Division of Westland Aircraft Ltd. next year will test a hovercraft designed to carry 88 people at a speed of 70 kt. Other British firms working on hovercraft are Bristow Helicopters, Folland Aircrafts Ltd., Warton Aircrafts and William Dewar & Ross Ltd.

NASA Contract Stirs Discrimination Issue

Washington—Award of a contract to Garfield-Holmes & Co. to rebuild the Marshall Le. rocket engine for Saturn and Nova booster follow-on was withdrawn last week by the National Aeronautics and Space Administration after the award announcement became a civil rights issue here and in New Orleans.

The President's Committee on Legal Employment Opportunity pointed out to NASA on Oct. 24, several days after the award was made, that a partner in the winning firm, Martin Corlier, is allegedly an ex-convict.

A subcontractor on all living building firms was listed in the contract, which took a national stand in opposition of the New Orleans Parish School Board last year when school segregation was at issue. After the award, the President's committee received a copy of a letter pasted on the contract, written by Corlier to Hayes which contained a harsh denunciation of the Board's action on school desegregation.

NASA headquarters admitted that it did not know of Corlier's reputation when the contract was awarded to the Marshall Space Flight Center, but would not rescind it, since because it has found no evidence of discrimination in the company's operations.

Corlier's bid of \$668,017 (AW Oct. 23, p. 27) was accepted as being the lowest bid for considered best qualified to do the job. Since the project is on a company contract, the bid is considered the major financial factor by NASA.

The agency and Garfield-Holmes is one of four companies recommended by the Army Corps of Engineers. The company was selected on experience, familiarity with the Marshall facility, company organization, man-power and financial soundness. After the four contractors were briefed on the job, two additional contractors from New Orleans entered the competition.

News Digest

Violent Vigilante—with tank, missile will be ordered into production for the British army. Final contract negotiations are now being completed between the British Aircraft Corp. and the Ministry of Supply. Vigilante will also be evaluated by U.S. Marine Corps next spring.

Lockheed Aircraft Corp.—Board Chairman Charles H. Goss announced that Grand Central Rocket Co., Redlands, Calif., has been awarded the Lockheed Pegasus Co. Lockheed agreed complete ownership of the solid-propellant reusable launch line last Aug. 31.

Joseph H. Tippens, director of Federal Aviation Agency's aviation safety division, has been named assistant administrator for FAA's western region with headquarters in Los Angeles. Before that, he was regional manager, will be participating in the western region. During a long stint of the aviation staff division, has been named acting director of the business service.

Shirley SGL—two Indian transport helicopter was exhibited last week for passenger service by Federal Aviation Agency. Los Angeles Airways and Chicago Helicopter Airways each have at least four SGLs. Los Angeles Airways will take delivery of its first one next week and plan to begin service with it next month.

An F-105 will not attempt another Project West Ford launch using technology until it is absolutely certain that the initial attempt made from Atlas IV satellite has not been successful. As of his last work, scientists had not been able to detect any of the new displays and were closely examining telemetry data to determine if package had been received from Atlas satellite. If correct, that plus, it is possible that, in response, intended to release individual displays in orbit, at increasing rates slowly then expected.

Hughes Tool Co. has asked CAR to approve its plan to buy Alfa Corp.'s 90% controlling interest in Northeast Airlines. Hughes said in a letter to the Board last week, that it was prepared to create the financial integrity of North east if it is allowed to buy the stock. Meanwhile Northeast has asked Hughes for "insurance" funds to enhance operations pending CAR approval of the deal. Hughes also agreed to underwrite Northeast's fuel and oil costs after Oct. 31 subject to contribution after four days notice.



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AIR TRANSPORT

Boyd Says Fare Increases No Cure-All

CAB chairman calls for other solutions as airlines request variety of boosts, reductions in tariffs.

By Robert H. Cook

Washington—Civil Aeronautics Board Chairman Alan S. Boyd last week publicly denounced the philosophy of considering fare increases a cure-all for the airline industry's financial ills. Meanwhile, one carrier asked the Board for one increase and two asked for a new type of reduced carrier fare.

United, for example, asked for an increase of \$1 for first-class jet fares, a raise in first-class portion plane fares to those of present jet fares, and an increase in all coach fares of 5% plus \$1. National Airlines had filed earlier for an increase in coach fares from 7% of first-class fares to 85%. The United increase would become effective on Jan. 1 and the National increase on Dec. 15 if the Board approves.

Continental Airlines last week filed for a new flexible revenue check fare which would be approximately 25% lower than present jet coach fares on a majority of its route nation. Designed to "penetrate enough out to travel" to recapture the industry's profits, the fare reduction would go into effect on Dec. 1. It would cut the cost of flying from Los Angeles to Chicago, for example, from \$162 to \$77. To provide the same service, Continental would use a new aircraft design and with a 32-in. pitch. The carrier's Boeing 707 turbojets would be revised to hold 74 jet coach seats, 36 regular class coach seats and 28 first-class seats. They now have 44 first-class and 70 coach seats. Pre-packaged meals would be added to coach one, coach class passengers.

American Airlines later attacked the Continental filing with a competitive fare to protect its Chicago-Los Angeles and El Paso-Los Angeles markets. It could become effective on the same date. The major difference between the competing services is that American's coach seats will have a 30-in. pitch.

Industry sources speculated that other requests for fare increases and reductions might be added to those filed by late last week. The CAB has been told that the airlines have been in touch with the Board on such matters. The Board has been told that the airlines have been in touch with the Board on such matters. The Board has been told that the airlines have been in touch with the Board on such matters.

a sharp attack last week as Boyd sharply attacked the idea of fare increases on a speech before an air transportation symposium sponsored by the Connecticut General Life Insurance Co. at Hartford, Conn.

Pointing the problem of what government can do to separate unprofitable line profits, Boyd said the Board will want to other increases to reduce overall industry expenses before it approves fare increases.

"While I do not hold with those who say that the market for air travel is limitless and needs only slightly more than a light tap," Boyd said, "I shudder at an suggestion that the airlines have double-crossed all the people who will travel by air. To sit idly and simply figure out on the basis of present traffic volume how much of a fare increase is needed to cover expenses and a reasonable profit is to be an exercise in futility and, once done, not a successful death at that."

Volume Business

"I would say the ones if I were certain that the present volume of traffic would keep up at higher rates, and I am far from certain of that," Boyd said. "We can well tolerate a public service industry which runs planes half filled with captive passengers. The industry is all geared up and publicly committed to volume business, and once volume would be a word means, indeed, of contracting volume. While some fare adjustments, particularly in light of allegations that passenger fares have been increased, would perhaps improve the situation, a serious, seriously, doubt if the solid carrier has them."

Among the alternatives which Boyd and his board are such increases as

pooling agreements to reduce repeat fixed costs, route adjustments or route loss and mergers.

Under an estimated oversupply of lines, but it can be unnecessarily and severely expensive to the detriment of the nation and the paying public," he said with regard to pooling. "I hope that the airlines will overcome this inertia and doing up with some more, saving passengers."

Boyd said that while route adjustments would be more likely in the sub-subsided line situation, the Board has the authority to apply this to trunk operations and might do so to cases where it is concerned that competition is excessive and the airline has failed to make its share in the market among domestic trunk airlines. He added that the Board is "on the look of a few cases of this kind but not more."

Feasibility of Mergers

Martin, Boyd and "possibly" present the best solution to the problem which the airlines expect to have that is, excessive competition.

Whereas that financial conditions may give some, making it more difficult for airlines to secure a fair price for merging with other carriers, Boyd said that if the carriers do not act soon in their own interests, CAB should force them to merge. Airlines to split out which carriers should merge and should produce a report that would "disclose the merger situation in full."

"Where we do not have the power to really do a reasonable situation in air transportation, at least we can propose it and recommend corrective action," Boyd said.

Competition which Boyd said had grown in a number of airlines demanding more seats, routes, new airplanes, "more markets" in search of the "pot of gold" seen at the end of the rainbow—should be arranged to "break a balance between benefits and costs."

Competition should be tailored more to its interests and effectiveness than to the actual number of competitors. Boyd said. He expressed a personal opinion that the best competitive balance between airlines would be reduced by having only two carriers on routes between "high large cities." In some exceptional cases, he said, competition by one carrier could be justified, and "beyond a certain high density of traffic there might 'occasionally' be justification for three or more carriers on one route."

Britain, France Team on Mach 2.2 Transport

London-British and French aircraft firms will team to develop a Mach 2 plus transport with a 1970 operational target date as a result of improved governmental negotiations now being concluded between the two countries.

The Anglo-French consortium will utilize British Aircraft Corp., which now has a British government aerospace transport development contract, and Sud Aviation, which has been developing a supersonic Concorde (AV 19).

Although the official inter-governmental agreement has not been concluded, BAC and Sud are already laying the foundation for technical cooperation with subcontractors in BAC's VC10 and Model 111 jet transport components being negotiated with Sud. Present Anglo-French planning aims at a seating capacity of about 100 with a Mach 2.2 top speed and built in two low pressure, one for the transatlantic route and another to be built in the U.S. transcontinental area and the basic British and French Eastern orders such as London-Cairo and Paris-Island.

It is likely that Dr. A. B. Bresset, chief designer of Borel Aircraft before its merger with BAC, will direct the joint program.

Requests Due Soon for Research Plans on Supersonic Transport

Washington—Requests for detailed research proposals that will produce the preliminary design of a U.S. supersonic transport are scheduled to go out to industry before the end of this month. These proposals will form the basis for the awarding of \$11 million in research and development contracts, beginning in January.

The research and development work will run from one to two years but is expected to produce enough technical knowledge to provide the first design drawing of a supersonic transport by the end of next year. The development program is being coordinated jointly by the Federal Aviation Agency, National Aeronautics and Space Administration and the Defense Department.

FAA estimates that airplane design proposals could be expected within 12 to 18 months from the beginning of research contracts, and preliminary design proposals after two years of engine study and test work. Completion of these design phases could produce a prototype transport by 1966 and type certification by 1970. The studies by the three agencies include:

Early selection of an engine capable of meeting a wide range of thrust requirements is considered critical to the development of a transport and will claim a major portion of the research and development funds allotted for fiscal 1963. Total research requirements for both aircraft and powerplant studies for fiscal 1963 have been estimated at \$40 million to \$50 million.

Details of the research proposal requests, on the basis of current knowledge of supersonic transport design, are to be expected to follow these lines:

• Current emphasis on a study of new types of supersonic transport power-

plants continued and expanded into fiscal 1962. The U.S. Air Force now has contracts with both the General Electric, Clark and Pratt & Whitney Aircraft Division of United Aircraft Corp. to explore the efficiency and practicality of several turbine engine variations. Under these, six such new engine types are the turbojet-turbofan, turbofan and turbofan-jet.

• Extensive component testing program to be devised for new designs. This would include the most cutting of advanced component designs, along with new types of components designed to meet either new or conventional loads.

• Research into the problems of controlling airflow in and out of engine inlets. Under these, six such new engine types are the turbojet-turbofan, turbofan and turbofan-jet.

• Research into the problems of engine inlets. Under these, six such new engine types are the turbojet-turbofan, turbofan and turbofan-jet.

Wide Spectrum

Aircraft research programs would cover a wide spectrum of problems involving aerodynamic design, materials and structural, stress loading and engine systems.

Priority in this area will probably be given research on materials, since the supersonic transport is planned to have a life of 18,000 to 20,000 hr and there is now no reliable method to determine what effect this amount of exposure at high temperatures will have on the aircraft's construction.

On this basis, aircraft research would be concentrated on these areas:

• Study of stainless steel and titanium

alloys to select the metal capable of meeting the problems of long life, fatigue, crack propagation and corrosion.

• Research and testing to facilitate design details and structural strength details for variable geometry wing joints.

• Study of high lift devices necessary to permit supersonic transport operation at cruising altitudes. This would include means of improving high lift capabilities of fixed wing configurations, adaptation of devices to variable wing configurations, and their application to emergency landings where variable sweep aircraft have wings retracted or fixed wing aircraft have flaps deployed.

• Explore methods of further prediction during the design of wing.

• Studies of leading-edge noise and loads in order to arrive at desirable planning techniques for leading edges and loads.

• Research into methods of avoiding loss of cabin pressurization during high altitude operations and developing new analysis power systems capable of with standing the expected operating temperatures of 600 to 800°F.

Pannir Sees Need For 3 Super Caravelles

Paris—Pannir de Breda has indicated in a letter to Sud Aviation that a new way to produce three aircraft like the modern-range Super Caravelle is needed by 1967-68.

Pannir's intention was outlined in a letter attached to the Brazilian carrier's new order for two new Caravelles (AV Oct 23, p. 31). The letter stated that Sud Aviation should acquire three such supersonic aircraft by 1967-68, target date for initial Super Caravelle deliveries.

The letter in effect gives Super Caravelle delivery priority to Pannir over all future orders with the exception of Air France.

Legal status of the Sud-Pannir letter is uncertain. The document is a legal letter of intent but it does not create serious interest in the Super Caravelle by Pannir and implies its desire to order in specific quantities.

Recently, the French government learned of the desire to purchase Sud Aviation's configuration rather than the one proposed by Aerosud (Dassault-Sud's) configuration, disclosed in model forms during the Paris show last month (AV Week 5, p. 48). Certain on a double-deck wing form with wedge-type engine intake fitting under the wing trailing edge.

Dassault's reaction indicated a considerable loss of interest in the new aircraft in the United States. Dassault will continue to work closely with Sud on the Super Caravelle.

Short-Range Jet Transport Needs Studied

By William H. Gagey

New York-Eastern Air Lines has detailed a generalized specification of a short-range jet transport to replace the Conquest 440 or Martin 404 class airplane, but also is taking a serious look at other jet aircraft for the same or complementary applications.

Only one jet aircraft in the short-range class is considered in production—the British BAC 111 which British Airways ordered last month.

Of the trunkline-outside of British-Eastern has during the summer interest in a short-haul jet. American also is looking, and thus also is interested, though for other reasons, as the part of American in other wing aircraft.

Eastern needed top officials of local service airlines to do all seating in Miami last month to hear its staff design requirements for a short-haul jet, leaving it to the airlines to develop its own in the area. Carriers attending were Allegheny, Coastal, Lake Central, Mohawk, Mohawk, North Central, Ohio, Piedmont and Southern.

U.S. Studies

Eastern also appears to be studying U.S. manufacturers who have design studies of the short-range class (AV Oct 23, p. 41). These firms:

• Boeing 727. Boeing has based on one order on the line, one powered with a 7,000-hp thrust version of the Pratt & Whitney JT4D turbofan engine in the Boeing 727. Boeing is also studying a short-haul jet in terms of its V-107 two-tail, turbofan. With its heavy maintenance as the 727 program and its interest in the major problem in achieving a truly economic short-haul jet Boeing is hoping for free specification will be laid down for the carrier by a year or two.

• Douglas with its Model 740B fuselage is reported to have approached airline thinking about Douglas engineering team going ahead on the project several months ago, but by management moved along the plan because of Sud Aviation's interest and commitments of company funds for the DC-8T Trader cargo plane program. The 2000 is thus not currently active.

• General Dynamics has proposals in the light jet class but cannot accept the problems of its Conquest 440 make any new commercial offer doubtful.

Looked this has done studies in the small jet field, but airlines feel the company's interests are more concerned with a supersonic transport.

• McDonnell Aircraft has detailed its T37A twin jet proposal with various services, but has not been successful with results of its initial surveys.

• North American Aviation proposed a four-engine aircraft powered by the Continental Electric CF700 4-cylinder engine in the 1,000-hp thrust class. Airbus preference for a four-engine configuration has led to a twin-engine proposal.

• Sikorsky Aircraft has discussed under development a group under the designation S-65 with Eastern, American, and Trans World Airlines (AV Oct 23, p. 47). The concept on the order of the S-65 turbine engine in use would carry 60 passengers at a speed of 180 kt.

At stages below 100 mi, costs of the S-65 would be lower than Eastern's current jet program equipment, perhaps half as much as current rates such as Washington-Baltimore. Eastern's Executive Vice President, Charles V. Fennell, said the group:

STOL aircraft also could fit local service requirements but in terms of 1965 operations, only helicopters and short-range turboprop aircraft are likely to be available, Fennell said. No new aircraft appear likely to fit all short-haul requirements by 1965, and thus Eastern believes a mixed fleet of helicopters and dividing aircraft may be the solution.

For some reason, the Caravelle with a gross weight in the 30,000-lb. category, or the Boeing 727, with gross weight of 142,000 lb., will be utilized for the very short haul on the short.

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it would be less costly to operate than more economically at times other than has a new type of airplane.

National Airlines will be interested in trading its jet fleet for Caravelles (AV Oct 3, 1963, p. 39), but a new type order is unlikely. Delta Air Lines is a possible General Electric and Continental has also expressed interest in the BAC 111.

Most probable immediate order for the BAC Caravelle, however, are from two foreign carriers—Air France and Japan Air Lines.

The two-tail fuselage configuration was chosen by Eastern as going through some testing data since the staff meeting. At that time it would have had a maximum gross weight of 55,700 lb., a 14,000 lb. payload, and carried 45-52 passengers in first class configuration. New Eastern is thinking in terms of 65,000-lb. gross and 46-48 passengers.

Powerplants, to be run on two engines on the fuselage in Caravelle fashion, would be Pratt & Whitney JT4D-1 turbofan rated at 10,500 lb. thrust. May support for the engine reportedly calls for 58 million in the current fiscal year.

In order of importance, Eastern listed requirements as:

• Adequate payload, specified at 13,800 lb. in latest studies.

• Best low speed performance available. Landing weights are acceptable, but not loading weight device. Tailhook design may be more complex than double-ducted Fowler type as specified, but a



MODEL OF TWIN-JET BAC 111, which will be built by a British Aircraft Corp. Gagey, shows how the loading will look, as British International Airways' market. Breda has ordered no BAC 111, but is open to an order (AV Oct 23, p. 40).



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which all current operating jets take most add to stress degree.

A major problem in TAI on the development of a tourist trade has been the generally poor reaction of critics in the island. According to TAI officials here, only two out of 350 tourists—in an average—are enthusiastic on the first visit. However they found that the same interest is 4 out of 10 among visitors who stay for an extended length of time.

Airlines Heed Warning On Electra Hydraulics

Washington—Electric operators are complying with a second Federal Aviation Agency alert* to guard against malfunction of the hydraulic boost system on the tailoring aircraft (AV Oct 23 p 16).

Detailed orders on how to design the system, in the event of a hydraulic power failure during takeoff, have been included in the alert operating manuals on seven major airlines.

FAA's advisory was issued shortly after American Airlines directed its pilots to remove the forward engine cover the engine during takeoff and landing. Flight engineers were ordered to stand by to deactivate the boost system on takeoff at the captain's command.

American's order was issued just five days after the crash of a Northwest Airlines Electra at Chicago with a loss of 17 lives on Sept. 17.

During an safety hearings conducted by Congress last week the Flight Engineers' testimony stated that several members of the board of directors could never locate a manual because it was difficult to reach. This meant that complete loss of hydraulic pressure in the Electra could result in a locked flight control surfaces until the boost system is disconnected manually.

TWA Reports Loss

New York—Times World Airlines reports a net loss of \$12,713,000 for the first nine months of 1964, compared with a net profit of \$4,081,000 during the same months of last year. Net loss for the third quarter of 1964 was \$4,099,000 on operating revenues of \$36,171,000. In the third quarter of 1964, TWA's profit was net profit of \$6,079,000 on operating revenues of \$11,325,000 (see p 32).

Revenue passenger miles for the nine month period ended 9/30/64 while available seat miles increased 49% before passenger load factor rose 18.4%, from 65.5% to 77.1% for the same period of 1963.



PRELIMINARY specifications of the Mach 3 Lufthansa transport cited include: design length between 180 and 190 ft., a short design of the aircraft maximum takeoff weight between 351,000 and 440,000 lb.

Lufthansa Favoring Mach 3 Jets For Transatlantic Replacements

By Edith Wallfied

Germany—Düsseldorf, Lufthansa West German Airlines faces a Mach 3 replacement design as a direct replacement for its present fleet of subsonic jet transports for transatlantic service.

The choice of a Mach 3 to Mach 2.5 aircraft, as it now being planned in Great Britain, would be Lufthansa's opinion, says GfL an intermediate engineering and aircraft design organization. It is now preparing equipment when U.S.-produced Mach 3 versions appear on the scene and are adopted by competing carriers.

A Lufthansa spokesman said the company does not necessarily intend to fly such aircraft at their maximum speed initially. The plan is to be equipped with an advance for the Mach 3 era which the company feels is based to come.

According to Gerhard Hilde, a member of Lufthansa's board of directors, the West German carrier is convinced of the need to invest in such a replacement with all the technical and operational problems which will accompany the introduction of supersonic transport aircraft when it becomes a reality, in about 10 years. To avoid loss of time and development costs, he says, any present under development should incorporate the future needs individual requirements a major modification for any Lufthansa order. It is unusual, Hilde said, that manufacturers and airlines agree on design elements, on general, such together as closely as possible during design and development of supersonic jet aircraft. These considerations have led Lufthansa

to produce its own result of a Mach 3 aircraft which it believes will fit as long-range more structure, needs in the early 1970s Hilde said. The model was prepared after careful study of the design carried out by consultants in the U.S., Great Britain and France and a thorough discussion of the project with the aircraft industry.

Preliminary first prototype specifications were cited by Lufthansa officials:

- Fuselage length between 180 to 190 ft., or about double the span of the aircraft. (Length of a Boeing 707 is about 131 ft., its span 142 ft.) Fuselage of the supersonic Lufthansa version would therefore be considerably longer and its span much less than that of current jet transports.

- Assuming that the aircraft can cruise between 180 and 190 passengers, maximum takeoff weight would be between 351,000 and 440,000 lb. (Takeoff weight of a Boeing 707 is 116,000 lb.)

- Proposed Delta wing of the Lufthansa design would be located near the rear of the fuselage and the elevation in the forward fuselage section. This raised form of construction offers considerable aerodynamic advantages when flying at supersonic speeds, according to Lufthansa engineers, Hilde said.

For example, while discussing this arrangement, Hilde said, the aircraft's wing is the opposite effect of de-energizing lift and producing additional drag, when, as it is, the elevation are created in the tail.

- Lufthansa prototype (probably) would have four engines mounted underneath the wings at the rear of the fuselage, but no decision has yet been reached on whether these will be the jet, prop, or turboprop type.

JT8D

The JT8D is the latest Pratt & Whitney Aircraft commercial turbofan engine. Many of its characteristics come from other proven Pratt & Whitney

**THE POWER FOR
BOEING'S NEW
727 HAS A BLUE
RIBBON ANCESTRY**



Aircraft jet engines.

The JT8D utilizes the same design philosophy and basic technology of the jet engines which have more than 15 million hours of performance and reliability to their credit. Also from these proven engines, the JT8D inherits a sound, sophisticated jet design. And from the JT3D turbofan, which powers the fan versions of the Boeing and Douglas jets, comes the essential design for the fan structure of the JT8D.

American Airlines, Eastern Air Lines, Lufthansa and United Air Lines have all ordered this latest turbofan engine for their new Boeing 727s. Turning out 14,000 pounds of take-off thrust, the JT8D helps make it possible to operate efficiently from runways that used to be too short for modern jet travel. Now additional cities coast-to-coast will be connected to the rest of the world by jet.



PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION

Airline Traffic—August, 1961

	Revenue Passenger Miles (000)	Revenue Ton Miles (000)	Passenger Load Factor, %	U.S. Mail Ton Miles	Express Ton Miles	Freight Ton Miles	Total Ton Miles	Overseas Load Factor, %
DOMESTIC TRAFFIC								
American Airlines	607,491	588,452	40.3	2,075,370	1,841,200	11,871,136	15,787,566	54.9
Boeing	15,431	15,124	36.5	425,110	300,490	1,811,822	2,537,522	42.9
Continental	118,679	62,420	44.8	260,220	126,542	1,575,037	2,961,789	40.9
Delta	354,519	175,261	56.3	4,364,226	280,781	1,807,901	6,452,908	58.1
Eastern	614,794	327,523	49.8	3,375,427	333,549	2,147,844	5,856,820	59.0
Eastern	151,360	77,661	44.8	428,900	81,879	1,204,441	1,714,221	59.9
Northwest	177,846	122,267	44.8	642,247	348,770	1,335,091	2,326,018	51.6
Northwest	446,265	428,205	51.2	1,322,122	791,244	3,522,461	5,635,827	51.6
TWA	1,445,348	785,061	58.2	4,176,652	1,464,647	8,764,881	14,406,181	51.1
United	545,211	195,641	49.2	324,543	84,545	542,274	941,362	47.2
INTERNATIONAL								
American Airlines	6,818	6,826	59.9	6,410	884	263,221	270,415	46.7
Boeing	9,799	10,671	59.9	4,610	—	107,380	116,600	51.5
Continental	4,176	2,894	70.1	2,126	—	12,482	14,714	71.9
Delta	2,011	1,251	61.6	—	—	12,779	12,779	44.2
Eastern	68,125	65,167	49.6	136,293	—	339,564	475,857	46.2
Eastern	25,541	12,779	41.3	—	346	6,670	6,916	42.7
Northwest	22,327	21,341	56.1	5,179,414	—	788,174	5,967,588	58.2
Northwest	—	—	—	—	—	—	—	—
Pan Am	9,522	5,564	54.2	50,047	3,840	210,122	274,013	50.7
Pan Am	178,777	128,456	71.9	2,816,150	—	4,348,741	7,182,941	51.5
Pan Am	134,417	75,041	55.8	4,615,240	—	22,446,710	31,112,000	71.4
Pan Am	21,433	10,126	70.2	3,443,526	15,287	5,536,151	9,004,904	44.2
Pan Am	11,007	20,323	62.4	70,610	—	444,740	515,963	41.4
Pan Am	779	242	27.7	440	—	494	936	36.4
Pan Am	11,312	18,292	65.7	—	—	491,214	502,506	49.1
Pan Am	23,477	19,227	80.7	1,441,138	—	2,221,131	3,662,269	49.4
Pan Am	23,223	43,338	49.6	19,559	11,275	9,714	30,548	51.0
Pan Am	6,553	5,264	72.9	5,847	—	29,329	31,630	52.2
LOCAL SERVICE								
Albany	62,240	37,374	43.2	76,420	44,647	70,497	1,711,262	46.4
Albany	27,291	6,772	43.9	1,280	2,220	14,328	16,827	46.0
Albany	18,719	1,005	34.0	1,701	4,884	400,438	402,923	49.7
Albany	34,448	6,634	29.3	26,441	12,823	73,363	1,010,181	48.8
Albany	12,564	6,218	22.7	—	—	37,547	47,291	47.8
Albany	64,771	12,831	44.1	28,351	27,644	36,898	1,417,544	42.1
Albany	302,524	70,221	47.6	38,367	45,013	12,811	2,084,644	47.2
Albany	16,544	6,327	44.3	32,248	47,427	712,411	817,686	49.7
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Albany	16,544	6,327	44.3	32,248	47,427	712,411	817,686	49.7
Albany	34,448	6,634	29.3	26				



The Boeing 727: a versatile, short-haul profit-maker

The new twin Boeing 727, now entering production, is a versatile airliner designed to operate profitably over route segments ranging from 150 to 1700 miles.

The 727's low operating cost will enable it to produce a profit at short ranges, even with modest load factors. Yet its generous cabin space (79 lie-flat seats or 113 tourist passengers) results in outstanding economy on high-density routes, comparable to that of the largest jetliners.

The 727 will be a rugged jet capable of handling frequent landings and takeoffs. A 2000-gallon fuel capacity, plus

high allowable landing weights, will enable the 727 to make frequent stops over a long distance without refueling. This, and other features, such as an integrated passenger stairway, will minimize service time during stops.

The 727's quick takeoff, fast climb and zero-600 mph speed will result in block speeds never before attainable in short-haul operations.

Already, 117 Boeing 727s have been ordered by American Airlines, Eastern Air Lines, Gulfstream Gwinn Airlines and United Air Lines for delivery beginning late in 1963.

BOEING 727

CAB 'Use It or Lose It' Study Urged by Locals

Las Vegas, Nev.-City Aeronautics Based on Carson should make a comprehensive study of the feasibility of changing the "use it or lose it" policy now applied to local air routes before deciding on such application concerning cities which have lost service under the policy, the Assn. of Local Transport Airlines concluded at its regional quarterly meeting.

Leslie Barnes chairman of ALTA and president of Alhambra Airlines, told Aeronautics Week that if there is to be a new national policy on federal subsidized service to cities that cannot now be served economically, it should not be the byproduct of a route case.

At issue is the possible creation of a "third level" of scheduled and subsided air service for the CAB routes in the 15-Passenger case. 15-Passenger Airlines is an air taxi operator in HIL City, Kan., which is proposing service with light twin engine business jets to 47 cities in Kansas, Colorado, Nebraska, South Dakota and Missouri.

ALTA is arguing that no "third level" be created to compete with ALTA members. CAB is scheduled to hear the 15-Passenger case next month. Officials have already been submitted. ALTA members on the case has as much as hoped importance as the original creation of the "second level" local service airlines.

Barnes pointed out that local service carriers are based on the board's "use it or lose it" policy to abandon service to communities which do not supply five passengers a day to their local carriers. Air taxi operators now holding to provide scheduled and subsided services are in many cases planning to serve communities dropped by local service carriers under the "use it or lose it" criterion. The criterion can equally well be maintained government subsidy by cutting out service services in its economic value approach. Barnes said that if the criterion is to be relaxed or eliminated, existing local service carriers should be allowed to provide the service under the new basis.

A critic of the ALTA position accused the local service carriers of adapting the same arguments that were used against them by the big trunklines when the local service airlines were trying to get started. He told Aeronautics Week that the third-level operation are proposing to make scheduled service more economical for ten small volume routes by using much smaller aircraft than the local service carriers.

Ultimately, the use of such aircraft will be complicated by Civil Air Regulations originally designed for larger transport category aircraft.



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Is permanently out...**

with Sylvania's Visual Glide Slope Indicator

Here's the remarkable new lighting system that makes landings safer and easier than ever before. It's the Sylvania Visual Glide Slope Indicator. Now being installed at major metropolitan airports. Veteran pilots praise it. Here's how it works:

When a pilot comes in too high, he sees a double bank of white lights on either side of the runway. When he comes in too low, he sees a double bank of red lights. When he comes in just right, on the correct glide slope, he sees one bank of red and one bank of white. It's a major advance in airport safety, and it's ready to work for you now. Consult us for applicable FAA and military specifications.

Whatever your airport lighting problems, Sylvania has the lighting system and technical assistance to solve it. For information write to Special Products Division, Sylvania Electric Products Inc., Essex Street, Ipswich, Mass.

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Raytheon solution for space

Recovery of space vehicles is a long range problem, commencing at atmospheric entry. Techniques for control from re-entry through touchdown, developed by Raytheon, are comparable to GCA concepts. Over the past two years, Raytheon has conducted a major and continuous investigation of the means by which a manned maneuverable space vehicle can be returned safely from flights in space to normal routine landing on earth. These investigations have included operational

control concepts, instrumentation, information flow analysis, basic system requirements and subsystem specifications.

Part of this effort was a space vehicle recovery study for the Air Force Flight Test Center encompassing vehicle energy management, glider characteristics, trajectory analysis, flight parameter accuracies, range instrumentation, navigation, communications, data processing display, and human factors.

vehicle recovery: LONG RANGE GCA

Other portions of the effort included earth return navigation and recovery studies for SLOMAE (as a subcontractor to the Martin Company), and joint efforts with Bell Aerospace Company on DYNA-SOAR Terminal Navigation System.

Currently, major emphasis is being placed on the APOLLO Ground Operational Support System (GOS8). This system will include global range instrumentation for tracking; telemetry and communications;

and control, display and computation centers.

One of the world's largest scientific-industrial organizations, Raytheon has proven capability to create the required technology and manage every phase of a space vehicle recovery system — from early study and design through development, production and field support of operational systems and equipment.

Executive Office, Lexington 73, Massachusetts.

RAYTHEON COMPANY

EQUIPMENT DIVISION

RAYTHEON

Communications, Radar, Sensor, Guidance, Data Processing and Display, Coordination, Systems Design and Management, Basic Research

AIRLINE OBSERVER

► **First of new wage increases in the face of dwindling profits** is behind the airline industry's resistance to labor demands. Trans World Airlines, which had a \$12-million net loss for last nine months of this year, has endorsed the "wage push" as the most persistent type of reform. Eastern, which has been among federal targets to slash its ground personnel, estimates a 5% cut in its work force saves \$600,000 each month. An average of airline expenses last year indicated that flight crew costs alone were about equal to the airlines' depreciation costs for flight equipment.

► **Imp Airway Authority** is completing negotiations to operate the current limits of all companies in the country. Recent talks have included the question of training flag pilots and engineers in England so their use would be easier and operation instead of foreign carrier companies.

► **Carl Aeromarine Board** last week accepted a joint proposal by American Airlines and Eastern Air Lines to offer a new transcontinental service between Florida and California. Single plane service from Miami to San Francisco via Chicago would have created a new coast-to-coast service beyond that authorized by CAB last March in the Southern Transcontinental Service Case. The Board said.

► **United Air Lines** Carrolle has shown consistently high load factors of 95% to 99% in comparison with other and perhaps equipment out of Newark Airport (AW Oct. 16, p. 40). United is now waiting to see how the introduction of jet service at Newark by other carriers will affect this load factor. The Carrolle transport has a relatively high business load factor.

► **Hawaiian Airlines** is evaluating plans after seeking to combat intense competition on the routes of its DC-3 all-cargo aircraft. Airline executives have been told, crew and losses on its air-rail routes and now replacing DC-3s for freighter planes. 18 months due to resident carriers.

► **Northwest Airlines** is testing a new type for winning altitude which operates in the "electronic" package. Majority of industries now in use are plagued by a rise in frequency and have resulted in such a high percentage of false warnings that the Federal Aviation Agency plans to re-examine the adequacy of present systems.

► **Complete Air 743** turbo-prop transport service is undergoing full fatigue tests in a water tank at company's Woodbury facility to determine failure properties involving pressurization, acceleration and loading gear. Since Cabin has been tested in 12 ft. in double the working pressure, and air frame has been tested to 105% of ultimate design load in a static structural test rig. Three prototypes have flown for about 1,000 hours.

► **Eastern Air Lines** plans to apply to the Atomic Energy Commission for a license to use radioactive isotopes in non-destructive testing and select inspection of aircraft. Company has been using X-ray, eddy current, ultrasonic sound waves and other methods for this purpose.

► **TWA** local Airlines, with a 51.9% load factor, is claiming the highest load factor among airlines flying transcontinental routes for the last six months of the year. Revenue passenger miles increased 18% over the same period last year while seat capacity showed a 34.5% gain. TWA reported a total traffic gain of 17% for the period.

► **De Havilland Aircraft** has put a security clamp on its Trident three-jet transport pending its first flight scheduled for December. Reversal apparently is accelerating development of its competitor, the Boeing 727.

SHORTLINES

► **American Seal Airlines** and **Riddle Airlines** have Civil Aeronautics Board approval for an arrangement that would permit American to lease Riddle aircraft for use over American routes, owned by American-owned, pending the outcome of their proposed merger (AW Oct. 2, p. 4). CAB imposed a restriction prohibiting through plane service.

► **American Airlines** has transferred the New York portion of its unique cargo leasing department with its 60 employees to its Tulsa maintenance base.

► **Eastern Air Lines** will increase its weekend "Air Shuttle" flights between New York-Washington and New York-Boston on Nov. 12. New schedule will be six flights in each direction on Saturdays instead of four and 12 flights instead of eight on Sundays between New York and Washington. New York-Boston flights will be eight on Saturdays and 13 on Sundays in each direction instead of the present six and 10 flights respectively.

► **International Air Transport Assn.** reports its London closing losses, which handles member airlines' transactions, did over \$1.5 billion worth of business during 1960, an increase of more than 50% over 1954.

► **Local service airlines** flew over 876 million revenue passenger miles for the first eight months of 1961 compared with over 749 million during the same period last year, according to Air Transport Assn.

► **Northwest Airlines** reports a net income of \$614,222 for September compared with \$593,272 for the same month last year. Income came in spite of a drop in operating revenues from \$11.4 million in September, 1960, to \$11.1 million last September.

► **Pacific Northern Airlines** has CAB permission for a lease to fly Boeing 720 jet transport for scheduled service next May. Caravanair was made on lines that had the jet. The carrier would not need solely after April 1965. The airline is being around 20 not needed by a lease program.

► **Trans World Airlines** last month flew its last international passenger flight with prime equipment. Flight was between New York and Rome with a 743 Lockheed Constellation. All of TWA's international passenger flights are handled by new jet transports which replace 14 piston aircraft.



COLLINS DME PINPOINTS POSITION CONTINUOUSLY



Adoption of the newest advance in aircraft navigation — Distance Measuring Equipment — is already paying dividends in cockpit efficiency, operational economy and traffic utility. As the major manufacturer of Distance Measuring Equipment, Collins has been the exclusive choice by 11 of the nation's key airlines. The Collins 1600-DME provides accurate, instantaneous and continuous position information throughout flight. It permits the pilot to rapidly determine ground speed and ETA's and to efficiently execute holding patterns, orbital fly-passes, traffic maneuvers and weather detours with ease and confidence.

COLLINS RADIO COMPANY • CEDAR RAPIDS • ILLINOIS • BOWLING • NEW YORK





PILOT-CONTROLLED LUNAR landing simulator at Langley Research Center uses a three-axis chair and a two-axis spot, station target projector. The pilot is able to visually compare his intended course in a lunar rendezvous encounter.

Pilot's Role in Space Maneuvers Examined

By Edward H. Kolczak

Langley Field, Va.—National Aeronautics and Space Administration is watching astronauts' eye during heavily on approach guidance and control equipment to establish a basic framework for translating rendezvous and docking requirements and lunar landing and takeoff techniques.

The basic philosophy of a lunar space rendezvous program here is to give the pilot the same degree of responsibility he has in an aircraft, not to rely on his senses as an astronaut's inherent backup for "black boxes."

Arthur W. Vogler, assistant chief of the Guidance and Control Branch of Langley Research Center's Aerospace Mechanics Division, contends that man in the rocket harness doesn't reduce the ability of the pilot. Refusing an pilot response to visual cues, such as showing a flashing light in the rendezvous phase, can eliminate human and complicated electronic and radio aid however, and increase chances of man error several hundred per cent, Vogler adds. Langley's simulator program is

designed to give the center a capability to develop pilot techniques and to determine pilot limitations, in these areas:

- **Rendezvous tactical maneuvers** employing two procedures. One involves a three step controlled by the pilot approaching a target. The other calls for the pilot to control the chase in his spacecraft.

- **Docking two vehicles** while in orbit. Once the terminal maneuvers are successfully completed, Vogler said, the docking maneuver will be easier than moving a ship in heavy seas.

- **Lunar landings and takeoff**, which under Langley studies would follow helicopter landing techniques with cross-based horizontal and vertical velocity in accuracy.

- **Re-entry maneuvers** with both rigid body configurations and variable Apollo shapes.

- **Reentry maneuvers** in which a pilot can make a ballistic wing to bring a spent launch vehicle back to earth for reuse.

- **Takeoff procedures** for improving transport centers. This program is tied to a supersonic transport landing simulator at NASA's Ames Research Center.

Langley also has simulate rendezvous, re-entry, lunar and supersonic transport takeoff and landing maneuvers. In putting the pilot in a closed loop linked to a general purpose Electronic Analogizer, Inc., analog computer, Guidance and Control Branch, headed by W. H. Phillips, has devised an inflatable platform to add realism to the simulated maneuvers.

A picture of the lunar surface is projected on a screen in lunar landing simulation, and the picture grows or decreases in relation to altitude. In rendezvous studies, Langley uses a star background and the objective spacecraft as a floating light.

Earlier this year, Edgar C. Lindberg and Max C. Korman of the Guidance Branch developed a star pattern guidance light to eliminate complex, heavy hardware. The scope is fixed to a distance zero and to the target vehicle, and the relative constant between target and chase can be monitored continuously. If the pilot is not on a collision course, the target will drift rapidly away from the reference star.

Kolczak said that after several man-

with the visual display, it has become apparent that the pilot is able to detect angular rates more accurately by eye than by instruments.

New Simulators

NASA will extend Langley's lunar later capability with two sizable facilities, one a docking device to be located in the old Wright Research hangar, and the other an outdoor lunar landing device (see photograph) built to be completed by February, 1963. Construction will begin early next year and will cost an estimated \$3.5 million.

Docking simulators will be a roller-suspension arrangement able to traverse over 200 ft of the hangar, with a target ship capable of three linear and three rotational motions. A guided rate will simulate the chase and roll-up through one degree of lateral and three degrees of transverse motion.

Lunar landing targets both will be 40 ft long, 30 ft wide and 180 ft high. It is being designed to accomodate full-scale Apollo lunar landing configurations, and also, possibly, serve to check the flight vehicle before the lunar mission. The overhead report system will be used to drive to zero that the target vehicle cannot be lost.

The device will simulate 50 ft/s horizontal and 30 ft/s vertical velocity measurements. A guided system will allow freedom in pitch and roll and yaw.

One of the most fruitful results of the Langley simulator design program has been educating students in rendezvous potentials and problems which have evolved into at least one concept, those that could accelerate the Apollo lunar landing mission.

Lunar Rendezvous

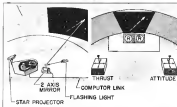
The concept in lunar rendezvous, as opposed to the generally favored earth rendezvous procedures, would be to launch second C-3 vehicle by a direct lunar orbit, assemble the lunar landing vehicle while in a lunar orbit, and spot the lunar lander, which would return the lunar orbiter after its mission.

Each rendezvous would involve essentially the same procedures, but the lunar leader in this method would be launched from an earth orbit. Most attractive feature of the lunar rendezvous are:

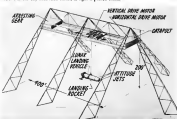
- **Schedules.** All development work can be done with the Saturn C-1 launch vehicle and all missions can be done with the C-3. The C-3 is a cluster of two Redstone/F-1 stages, each developing 1.4 million lb thrust. If NASA goes the C-4 route, this would require the lunar rendezvous capability. NASA expects to select either the C-3 or C-4, which is a four-engine F-2 cluster, for rendezvous technique development.
- **Costs.** Both for intercept and launch. Vehicles launched for earth



HUMAN ABILITY TO CONTROL landing maneuvers for lunar landings is simulated through a Lockheed analog computer at Langley Research Center.



TERMINAL PHASE of rendezvous is simulated as two techniques using computer links. Left is manually controlled chase; right is piloted chase.



MAINED LUNAR LANDING SIMULATOR, to be built at NASA's Langley Research Center, will handle vehicles up to 20,000 lb, with rocket thrust up to 50 gals.



In Mercury Control Center room at Cape Canaveral, dedicated under supervision of Bell Telephone Laboratories, NASA flight controllers make all vital decisions concerning a Mercury mission. Large maps illustrate spacecraft status at tracking and communications (left), control of emergency needs, the position of the capsule and its "remote data link" point.

Bell System manages building of global communications network for Mercury spacecraft

On September 15, National Aeronautics and Space Administration first achieved the orbital flight of an unmanned Mercury spacecraft, using a new worldwide communications and tracking network.

Soon, will come manned orbital flight.

The Bell System has played a large role in the development of this scientific project.

Western Electric headed an industrial team, on which Bell Telephone Laboratories also played an important part, in building the worldwide network of tracking and monitoring stations.

This 80,000 mile communications route, the bell

of which is white-gewitter and telephone circuits, first together 12 tracking and instrumentation sites with the Goddard Space Flight Center in Greenbelt, Md., and the Cape Canaveral Mercury Control Center.

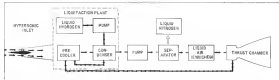
As a Mercury capsule orbits over the area covered by each site, the far-reaching communications net work immediately begins feeding information on received from the capsule with clockwork precision. So fast and efficient is this communication system, it takes only seconds for data to start flowing from any site through Goddard to Cape Canaveral.

The Bell System is proud to have contributed its creativity and resources to this vital project and to the further advancement of global communications.



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SCHEMATIC DIAGRAM OF LACE concept shows air flow from hypergenic inlet through various stages to thrust chamber

LACE Concept Feasibility Proof Sought

By David A. Anderson

New York—System engineering aimed at proving feasibility of the concept has begun on Manassas Corp. a liquid air cycle engine (LACE).

One of a number of possible and past-proven concepts for USAF's Aerospace Plane concept (AWF, Jan. 19, p. 54), LACE is basically a rocket engine operating on liquid hydrogen as fuel and liquid air as oxidizer. The liquid hydrogen is carried along in part of the gross load of the vehicle, but the liquid air is manufactured from atmospheric air scooped out during flight and released by a refrigeration process using liquid hydrogen in the coolant.

A further development of the concept which is called NULACE (nuclear liquid-air cycle engine) combines the LACE concept with a nuclear rocket engine and is meant to obtain enhanced specific impulses by use of the nuclear rocket alone.

Both these Manassas concepts are aimed at achieving economies in the costs of putting payloads in orbit or beyond. Company calculations show costs on the order of \$18 to \$50 per pound in orbit, which compares with about \$5,000 per pound in orbit today using Decatur rockets. Manassas says these economies can be traced to the engine performance which can show specific impulses which are multiples of those obtainable with liquid propellants in nuclear rockets.

Engineering Team

Two firms with specialized and extensive experience are now working with Manassas in LACE system engineering. General Corp., responsible for heat exchanger work, and Rockwell International, responsible for the LACE engine, are working jointly with Manassas in development of the separately cooled thrust chamber but each responsible for the liquid hydrogen pumping system.

Manassas engineers also are working informally with several aerospace project teams interested in using the cycle in their proposals for Aerospace Plane. The company's position is still strong because the LACE concept is regarded with Manassas as an outgrowth of its own work on advanced vehicle engine concepts. But the company expects competition in the near future from Pratt & Whitney Division of United Aircraft Corp. on the lines of that group's experience with liquid-fueled jet engines. General Electric Co. is also expected to provide some serious competition at a later date.

Feasibility of both LACE and NULACE concepts hangs in a question as to the needs of Manassas engineers. The company has stated that progress in both programs is "most encouraging, and component performance already achieved suggest that no major technological breakthroughs are required."

But outside the company there are both doubts and support. Strong support for the LACE concept comes from Air Force Systems Command's Aeronautical Systems Division, where the Aerospace Plane project was set in motion by Col. A. E. W. Wright, Deputy for Technology (AWF Sept. 25, p. 159). There is skepticism of higher levels in USAF and Department of Defense, particularly in the latter organization which is suggesting that feasibility be defined until feasibility is definitely proved.

Manassas engineers feel LACE is a step toward such a feasibility study. They point out that the LACE cycle is based on the burning of hydrogen in liquid air in a thrust chamber. This has been made in an 18-in. thrust chamber. That chamber has been in a test cell. Rockwell's ML-4 liquid hydrogen pump, engine and separator is in a test cell. Project Pluto nuclear rocket program, a being adapted to the LACE cycle.

Generally, tests of portions of the

system are being made in General Electric's 44-in. hypergenic thrust under a \$110,000 contract. Test work began in September and the contract "covers lots of testing" according to a laboratory spokesman.

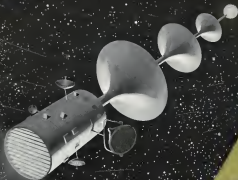
For further testing, portions of the system could be flown through test designs experimental on bell-like turbines in part of a rocket engine. Specifically, the heat exchanger tests still to be done at testing, because only a portion of an industrial quantity need be tested to establish operating characteristics. No specific research rockets are assigned to test the system in that test area, but there are proposals describing that work as being essential to final proof of feasibility.

Cycle Details

LACE is basically a rocket power plant burning liquid hydrogen and liquid air. It differs from other rocket power plants because it carries only as fuel of the gaseous as part of the vehicle's total weight. It provides means to combine during a sustained portion of the vehicle total flight path.

Liquid hydrogen serves as a fuel power as it is fuel for the rocket engine, and it is oxidizer for the heat exchanger which are part of the hypergenic manufacturing cycle. According to a schematic diagram shown in model form by Manassas at the recent American Rocket Society Space Flight Report to the National Aeronautics and Space Administration (NAS, p. 20), the liquid hydrogen circulates from the storage tank, through a subcooler pump, and then goes to the thrust chamber.

It is cooled by the engine inlet system power first through a pre-cooler and then through a condenser which provides the air. It passes through a pump, which provides it with a high flow rate, and then goes through a separator which provides gas rid of some of the liquid hydrogen. The oxidized liquid air is then pumped to the



FACING THE FOURTH DIMENSION IN PROPULSION DEVELOPMENT

Whether the universe has a "stable stage," or any stage at all, is a matter of interesting conjecture. The matter of space travel, however, is the subject of intense investigation. A nuclear/thermionic/ionic propulsion system, currently being studied at Lockheed Missiles & Space Company, might well become the power source for space vehicles.

Its design incorporates a nuclear reactor only one foot in diameter, generating heat at a temperature of 1850°K. This is transmitted to tanks of thermionic generators, converting the heat directly into electrical energy for the ion beam motor which uses cesium vapor as a fuel. The entire system is designed without any moving parts, increasing the possibility of failure.

Lockheed's investigation of propulsion covers a number of potential systems. They include: plasma, ionic, nuclear, unique concepts in chemical systems involving high energy solid and liquid propellants, combined solid-liquid chemical systems. The fundamentals of magnetohydrodynamics, as they might eventually apply to propulsion systems, are also being examined. Just as thoroughly, Lockheed probes all missile and space disciplines in depth. The extensive facilities of the research and development laboratories—together with the opportunity of working with men who are acknowledged leaders in their fields—make association with Lockheed truly rewarding and satisfying.

Lockheed Missiles & Space Company in Sunnyvale and Palo Alto, as the beautiful San Francisco Peninsula, is an exciting and challenging place to work. For further information, write Research and Development Staff, Department M-244, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense Industrial security clearance required. An Equal Opportunity Employer.

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This test stand for measuring rocket motor loads with experimental, high impulse rate pellets was designed and built for the first time. The Flex-Cell technique used by FluidDyne is shown in the diagram. The stand allows the user to add additional standard loads or flow rates, rated capacity at 720 pounds with overload protection to 75,000 pounds.

strong test, for later use as evidence in the actual engine thrust chamber.

All the supporting cycle provisions that the complete system is being at hypersonic speeds at some level of a light path which is low enough to furnish the supporting velocity of use, but high enough to avoid aerodynamic heat. One indication of the parameters of such a path is given by company studies made by Marquardt's Field Research Laboratory at Roswell, N.M. Cold Flow studies were made at 5000 psi in test of March 14 and 24-0000 ft.

Powerplant Applications

Most obvious application of the LACE system is the Aerospace Plane, a hydrogen-oxygen type of aircraft which is scheduled to enter stages in standard analysis from conventional rocket thrust, and other. In such a design, LACE would not be one part of the overall propulsion system which might use a hydrogen-burning turbojet for takeoff, climb and cruise, and a hydrogen-oxygen rocket for the final stages. At the point the engine configuration could be changed to that of a true supersonic engine—a concept that Marquardt has also explored thoroughly and successfully—with internal burning of hydrogen gas through jet nozzles.

Finally, the combination could help the on which in flight could reflect coolant had been accumulated to complete the rest of the mission using the power of the LACE system.

Another advantage of the LACE cycle is its different specific weights over the entire flight path. Marquardt says that the reduction of the gas pressure between LACE and actual atmospheric rockets is lost to one in four of the advantage.

The argument and other evidence made by the company here shows that large-scale reduction of space will demand impulsive, recoverable aerospace vehicles in orbit around. With the higher specific weights available, the practical result is that a vehicle series in orbit with a corresponding, larger fraction of its gross weight. This means more payload to orbit for a given gross weight on the earth's surface.

The need for increasing the size of payload to gross weight is pointed up by simple figures for a rocket vehicle being fired on the ground and fired in the air. The weight of liquid oxygen is more than 80% of the total propellant weight, which in turn is the major portion of the order 90% of the gross weight of the total rocket vehicle.

Obviously if the rocket could be maintained at some point in flight, and could be done so with relative ease, the weight saving could be huge.

Marquardt says the earliest, most positive vehicles are expected to show

a doubling of the weight fraction in orbit, compared with rocket-based vehicles of the same time period, with a further doubling possible in second generation designs.

In the advanced design, the company says that specific impulses at the air location would be even greater than that of rocket motors.

One step beyond Aerospace Plane is the orbital airplane, which can take station in orbit and then maintain on a space mission. NULACE, Marquardt's approach to the nuclear rocket engine, is one step beyond the company's LACE concept, and is being regarded in the near future for orbital airplanes.

Here again tremendous performance gains are claimed. Marquardt says:

...the performance of the combined engine is much greater than that of other engine tests. Uniquely, the performance of LACE and nuclear rocket are additive in the combination, almost without parallel in propulsion concepts. Specific impulses more than twice those of Space are obtainable.

But there are other advantages for such a system beyond the performance gains.

• **Solving the problem of nuclear addition in the lower atmosphere.** Marquardt studies show that NULACE, with higher specific than Space can reflect the rocket gases, could launch a vehicle off the ground to a safe orbit by starting the nuclear cycle up earlier.

• **As-thrusting portion can be started by variable geometry so that the engine can be operated in a conventional nuclear rocket in space.** The space operational flexibility from the surface of the earth right up into and through space without the hazards of nuclear reactor operations near the ground.

• **NULACE reactor can be several times smaller for its initial plant than for the Rover reactor intended to deliver equal payloads into space.**

Economic Analysis

Cost analysis made by the company indicates that both LACE and NULACE should achieve operating economies in the order of five to five times better than the best to be expected of conventional rocket systems. Marquardt figures that the life expectancy of developing costs below about \$100 to \$100 per pound in orbit with chemical rocket engines.

One example cited is a mass line weighing 1,000 tons, which requires 2,000 tons of additional material to support at completion of 100 years over a two-year period. Marquardt says that to transport five percent of payload only to an earth orbit would cost \$72 billion at today's prices. And if the most advanced rockets are used

valued, then the cost can be dropped to about one-tenth that figure, perhaps to \$7 billion. This is a reasonable amount, but not if more than one year project is being conducted from the ground. The specific test rocket tests for moving the load into orbit by means of an auxiliary plane concept show a figure of \$1.7 billion.

Continuing Progress

LACE and NULACE are two phases of a continuing program of study and development on extending engines which has been funded at Marquardt by USAF since 1948. Last year the Air Force reduced Marquardt's effort in developing pre-planned rocket engine applications, and it was this reduction that provided much of the impetus behind the two new concepts.

There have been tangible benefits on the ground program of redefining pre-planned development of the company reports. The BQ13-1 range payloads for the Boeing BQ13-1000. Some more direct on-ground work by the company is a dual cycle engine combining rocket and nuclear in a single combustion chamber and engine, possibly considered as the next step in pre-plans for the Rover.

Scout Probe Delayed Data From Ionosphere

Washington—F-15 probe launched by the National Aeronautics and Space Administration from Wallops Island, Va., in the Earth Scout vehicle development flight scheduled in approximately 30 min. of telemetry data as character of the upper ionosphere.

The experiment, flown Oct. 19, was the third of four ionosphere sounding flights planned by NASA. Next flight will be made with next test in a seven period and will measure ionosphere characteristics at night. The F-15 B-1 was designed to obtain a data profile of the ionosphere.

The four stage, solid propellant Scout carried the probe to a maximum altitude of 4,700 mi., and a range of 4,470 mi. Maximum velocity, sustained at burning burnout, was 75,000 ft/sec.

The flight was the second attempt to probe in the Scout development program, which is scheduled to end with the next launch. Previous probe was launched Oct. 1, 1959. Scout also has placed two satellites in orbit, the Explorer IX 12th, an earth sphere launched July 1, and the sub-orbital and rocket Explorer XIII launched Aug. 25.

PROBLEMATICAL RECREATIONS 91



At this moment, the hands of a clock in the course of normal operation describe a line somewhere between 4:30 and 5:30 on a standard clock face. Within one hour or less, the hands will have easily exchanged positions; what time is it now?

—Continued
It's time we talked of the Maryland Division of Loran Systems, Inc. You know of their systems and measures systems. But do you know they are also very large on instrument landing systems, electronic countermeasures, telemetry systems, electronic position indicators, fire control systems, and radar and surveillance systems? Well they are. They are in 4800 Colver Road, College Park, Maryland.

ANSWER TO LAST WEEK'S PROBLEM: The largest possible number is 39, 25.

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AERONAUTICAL ENGINEERING

Short Brothers Planning Civil Freighter

By Herbert J. Coleman

Bellini-Short Brothers & Harland, builders of the famous Bellini twin-prop cargo/passenger freighter for the Royal Air Force, will push the envelope in the world's largest and costliest contract in the logical long-distance carrier with-out-rival emphasis on a post-jet Bellini development.

Company philosophy is that the turbo-prop powerplants will be a dominant factor in the freighter's future with speed considered secondary to the period of up to 100,000 ft.

Still, Short Brothers is closely watching developments in planning and construction of the Lockheed C-141 military freighter for U. S. strategic needs (AW Oct. 9, p. 90) but the feeling is apparent that the large turboprop is a far more potent competitor in the operating cost parameters of the civil field.

The company's great winging dream, Hugh G. Cowell, goes a bit further than that, he sees the Bellini as the closest successor to the Douglas C-119 and stresses the fact that the Bellini design can be altered to an STOL version, using packaged Rolls-Royce RB 108 pure jet engines. An other major point is the vast cargo hold measuring 17 ft x 17 ft in cross-section with either lift or nose loading.

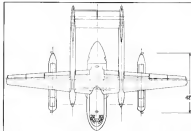
Civil Market

To enter the civil market, Short Brothers is expending considerable time and talent in working out the details of an integrated cargo system, from a unique double-floor design, to layout of its entire terminal facility.

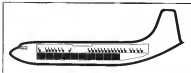
However, this increasing interest in the civil field is, of course, according to getting out the first 18 airplanes for the Royal Air Force, all of which will be allocated. Because of its military applications, Short Brothers has been chosen by the Air Ministry, but 2 weeks outside the company and the first Bellini could be rolled out early in 1961, as the base of work was under way.

Right now, three more sections are under construction, two of them still advanced. Greater sections of two airplanes are in the pits and panels are being cut. One delay occurred when heavy landing gear track distances fell behind, after finalities of a sub-contractor's forging machine, but this has been satisfied.

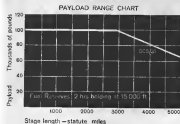
Production line for the 18 airplanes has been laid well established, although

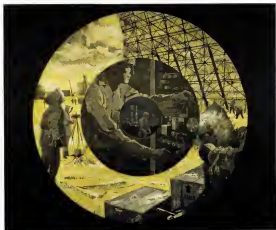


DESIGN conceived by Short Brothers & Harland in 1955 would have allowed conversion of a twin turboprop freighter into a tactical VTOL airplane by substituting lift engines in two pods hung in pylons, for two external test tanks.



SWING-WING Bellini would use 140 propellers as three-thrust configurations under forward firing. Entry doors are at rear of upper deck. Bellini is designed to carry 62,000 lb. of payload for 3,000 mi. (below).





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at present the list of the photographic reconnaissance Canberra built by Shant Brothers is mixed among Bellair bombers. Wings on a modification of those of the Bristol Britannia—the Bellair acquired at a large reserve of that surplus—and will be built by Bristol Aircraft for shipment to Northern Ireland.

The engine now being built is the SC 5/28, provided by two Rolls-Royce Tyne 50 turbo-prop engines, 5,750 chp, with an 11,000 cu ft cargo hold volume. Fuelled engines is 51,000 lb, over 940 stat mi at 140 mph, for extremely long range; it can carry 10,000 lb payload over 1,200 stat mi at 540 mph.

Variants of this version are:
• SC 5/28 tactical fighter, powered by Tyne R/F, 22 Stage 45 engines and 25 ft propellers for improved lift performance. Airplane is identical with the 5/70 version although the wings has been locked up along with the aft fuselage structure, for dropping supplies in areas of 15,000 lb, and weight. The 5/28 is designed for a prototype carrier role, using oil canvas tents fitted to the side of the hold, and another 60 in the center. Jump down would be 10 ft 4 in high and 3 ft wide. Used as a troop transport, the Bellair 70 could carry 147 soldiers with seats at a 55 in pitch. As an ambulance, it can be converted for 50 stretchers, 48 walking casters and eight medical attendants.
• SC 5/28 tanker, in which four packaged units carrying up to 30,000 gal would be supported on canvas in the center fuselage. Floor for in-flight refueling would be installed in a special way close.
• SC 5/31, the wingless version for civil uses (AW May 15, p. 47), a double-decker designed for London New York-Canada air freight routes with a 100,000 lb payload for a combined cargo-passenger load, it could load 141 passengers on the top deck and 60,000 lb of payload height on the lower deck.

Final version, which Shant Brothers will not discuss except in very general terms, is the Bellair with STOL capability and which has been submitted to the RAF tactical functional selection intended to replace the Blackburn Buccaneer now (AW June 26, p. 13).

The STOL Bellair would utilize three RB 106s mounted in a loop on the upper center fuselage, but this design appears to have been abandoned. In one effort, the Bristol 200 and Armstrong Whitworth 660 designs, both of which have MA 2 versions capable of 100% vertical takeoff (AW Sept. 10, p. 49).

Regardless of the final decision—and Cowen is convinced that at present, the need for VTOL is uncertain).

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—Short Boffin's is pointing its hopes as out of development of the STOL. Belia is against that of a completely new design, such as the two at a competing agency.

The compact form-and-one by an aircraft manufacturer in the political competition surrounding the cargo project. Unofficially, the word is the word will go to the company, most a word of warning, particularly in view of the fact that the British and American Whitworth designs are at least identical. In fact, two more, the company involved are British Aircraft Corp. (Bristol) and Hawker Siddeley Group (Astonbury, Whitworth).

Short Boffin, which currently has an employment of 10,000, has a more complex problem. The company is 99% owned by the British government and, in the past, the politicians have been toward avoiding contracts to purchase aircraft to escape criticism of rapid expansion, despite the wishes of a Short design.

A case in point is a Short Boffin design for a tactical transport capable of vertical takeoff, substituted to the Ministry of Supply in 1953 and based down on the grounds it was too big and noisy.

The design involved a twin-boom twin-engine transport, which in net respect, generally resembled the Aero Star Whitworth design, and which gained its typical lift from RD 105s pushed on either wing. Designated P10 in the Product Design No. 10, it has been kept under wraps at all times.

The firm told the Ministry that based on experience gained in design and construction of its SC 1 VTOL, it would include the transport, since could be transformed to a VTOL role at short notice, the jet lift pods would replace external fuel tanks.

The design involved, finally, a number of short-range, limited-range aircraft available for military use and with VTOL capabilities, without cost of a group of specialized single purpose aircraft. The pods, each holding 15 RB 105s arranged in three banks of six, would, in effect, be self-contained.

Control Nozzle

Forward and aft from the engine box, outboard structure would carry, suspended in ducting to the control nozzles, to provide a total of four air-to-thrust points in a rectangle about the airplane's center of gravity.

In part of the sub-structure, the, the plan suggesting the control pod structure would utilize the same wing fittings as the standard fuel tank plan with addition of a sub-structure. Bulkheads and longitudinal webs surrounding the engine would be dovetail, to connect firm to the two engines.

At the bulkhead position, transverse

members, together with four booms would form open frame in the lateral bending plane to allow top and bottom members of the pod to be tied to engine down, tank and general access down.

In this preliminary design, each group of six engines had a common fuel and oil circuit, throttle control, system common, starting as supply and control as well. An, two groups of the lift engines could, thus, have started to gather in as fuel from the main jet engine engines, in this case, two Bristol Siddeley Proteus 755, giving the short 1175 of thrust power more than.

The control structure and for driving fuel pumps, compressor or would have been tapped from even lift engine into the main thrust belt, and control as directed to the nozzles on the struts, ahead and aft of each pod.

Control nozzles were designed to avoid in the transition phase, either mechanically, or automatically, as coming to whether roll in the wing engaged. Pitch control was achieved by, thereby in the control down up stream of each nozzle, which varied the distribution of air between forward and aft nozzles. Height control, at cruise, was obtained by, used thrust reverser, using lift engine, thereby.

An auto-stabilization unit was mounted in the fuselage, and operated on the nozzle controls alone, its built-in roll and pitch. It did not have any effect on auto-stabilization control surfaces. Control stick, was not directly connected to the nozzles, but simply was

used the auto-stabilization. Yaw control was provided by direct connection of the nozzles to the rudder pedals.

To modify the P10 into a VTOL, transport from a base weight of 40,000 lb without the tank, pylons, Short Boffin would have added another 17,000 lb of which 510 lb would have been wing load-up, 5,000 lb for lift engines, another 5,000 lb for structure, fuel tank and nozzles, and the remainder for controls, fuel tank and nozzles, etc. for a new gross weight of 55,000.

Operational Weight

Three operational weight considering crew and loading engine would become 55,000 lb and, adding 36,210 lb for payload and fuel, maximum takeoff weight would have been 75,000 lb. Used in a VTOL, specific range would have been reduced about 75% from the standard aircraft. Thus from 1000 to 2500 miles at 1000 lb would have been 50 mi.

A VTOL design, corresponding roughly to this one was at one time considered by Armstrong Whitworth, but it has been cancelled in favor of placing more stress on use of Bristol Siddeley RB 105 engines with deferring nozzles plus wing tip jet lift engines.

Short Boffin is an agency has dropped its interest in possible group of lift engines. The company has been approached by a number of aircraft firms in other countries (at least one from the U.S.) and has been proposed



HOPEFUL of solving some of the Short Boffin's design, such as mounted in units with thrusting and only attached and suspended in engine which increase the fuselage sides, supported by heavy pods. Lighter pods help secure the units (integrated at cross section).

groundbreaking

- ▶▶ Some day—not far away in time—earthbound intelligence will set its eyes on the moon.
- ▶▶ First, perhaps, the robot explorer, such as the "Moonmobile," designed and developed by Space General Corporation, answering many of man's questions about his celestial neighbor. Ultimately—groundbreaking!—and the return to earth of the first substance from a foreign planet.
- ▶▶ Soft lunar landings have been studied in depth by Space General Corporation. America's uniquely capable source for space systems. Space General's management and staff have been part of this nation's ICBM, RFBM and space programs since the earliest days. Former accomplishments include the reliable Ablestar space engine. Others are in the making—advanced launching vehicles, commercial and mission-oriented satellites, space-based weapon systems and nuclear-powered space vehicles.
- ▶▶ These programs now create opportunities for scientists and engineers. Those capable of meeting high levels of skill and energy will be considered without regard to race, creed or national origin.

Contact Pierre Blaise, 777 Flower St., Glendale, Calif.

SPACE-GENERAL CORPORATION
A SUBSIDIARY OF AERODYNAMIC CORPORATION



ing with diagrams of V/SICOL, presently first for use, presently in the test program.

The company also is continuing its research in SC-1 flights, particularly in instrumentation and blind landing test ranges (AW Oct. 24, p. 79).

In a test spectacular this "Short Bread" on a proving its business being activities (company is a Bonanza development and a team currently is serving African interests), presently is completion of the first SC-7 Skyray light transport.

Skyray Development

A Skyray team of 15 men, headed by Frank Robinson, has the airplane on schedule for its first flight next, next year, the complete finalizing is taking shape and work is under way on firm wing sections for Skyray I. Skyray II is the turbine-powered version (AW Oct. 9, p. 107).

In addition, Continental is preparing to ship the first two 193 hp GT580-T20 piston engines, which drive 8.8 Hartzel propellers. Skyray II, on which work will start next year, is a turbine version using two 550-cip Turbomeca Astazou turbofans having 8-ft. Hartzel-Propellers.

Company, early in the future of the Skyray is reflected in Conway, who said he would build 10 airplanes immediately, if the funds were available. Interest has been shown by operators in Australia, Africa and Alaska (Waco Alaska executives have been visited the plant to check on progress).

No longer, the Skyray is a rugged, all-weather engine designed for tough operating conditions. Non-backlog stressed skin structure makes extensive use of Redux work panels bonded in large units using skin for example, in a single unit from end to end.

Payload of 3,000 lb is carried in a field measuring 16 ft x 6.5 ft x 4.5 ft. Instead of cargo, 15 passengers can be seated if desired. Dual controls will be offered only as an optional item. Current design also includes two small side doors which will be used primarily for access to landing gear in case of night landings.

SC-5/31 Specifications

Span	159 ft.
Length	236 ft. 8 in.
Height	47 ft.
Cargo volume	11,000 cu. ft.
fuselage diameter	17 ft. 7 in.
Wing area	2,466 sq. ft.
Gross weight	294,000 lb.
Capacity payload	300,000 lb.
Fuel capacity	95,000 gal.
Engine 10,000 lb. payload	4,150 shp. max.



Taber Transducer checks LOX injector pressure on Atlas engine at Rocketdyne

Before firing of all engines to make sure they're up to Air Force specifications is standard procedure at Rocketdyne, a division of North American Aviation, Inc. As the Atlas Booster engine is readied for testing, attention focuses on the Taber Blended Strain Gauge Pressure Transducers used to measure gas pressure LOX injector pressure.

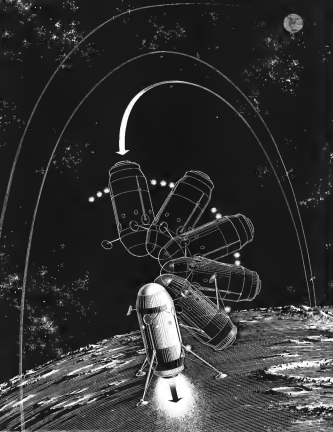
Taber Transducers are ideally suited for checking pressures such as this, as well as for numerous other laboratory, industrial, general engineering and aerospace applications. A wide variety of models is available in pressure ranges from 0-50 to 0-50,000 psi. Among the many features which contribute to rugged, dependable performance are: high frequency response, maximum hysteresis, infinite resolution and low sensitivity to temperature effects, vibration and shock.

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A New Achievement in Precision Controls for Space Application

Marquardt Documents 1,000,000th Pulse of Radiation Cooled Bipropellant Rockets

A three year research and development program directed at advanced space propulsion and control systems reached a significant milestone on September 8 when The Marquardt Corporation documented the 1,000,000th re-start of radiation cooled bipropellant pulse rockets. These rockets, operating at pulse frequencies up to 500 cycles per second, demonstrated that combined response and delay times of 906 seconds and effective pulse widths of .003 seconds are now attainable. Development to reduce these times is currently in progress. Typical of Marquardt's pulse rocket development is the range of 0.5 to 100 lbs. thrust in a 25 lb. thrust rocket for a current satellite propulsion requirement. This engine demonstrated an instantaneous operational life of over 50 minutes at rated thrust, and has achieved a remarkable 46 minute continuous run. At the end of the test, there was no evidence of system deterioration. This type of rocket engine has repeatedly demonstrated a specific impulse of 310 seconds using hydrazine and nitrogen tetroxide as propellants.

Coupled with Marquardt's secondary injection, preburning techniques and throttleable rockets, these pulse rockets make possible a range of control systems that can meet the most advanced space control requirements. In a complex lunar landing system, a Marquardt system can provide main course velocity control, orbital system injection, deorbit-coast control, and lunar circumnavigation.

Marquardt's sixteen years of research and development in controls have led the company into many pioneering areas in the aerospace field. Its variable thrust engines, Marquardt rockets, using throttleable liquid propellants, proved an average 1% efficiency of 30% over a wide throttling range. Successful investigations and developments have been achieved in injectors for thrust vector control, including tap-off of hot gases from the primary combustion chamber, cold gases such as nitrogen or air, non-reacting liquids such as freon and reacting liquids such as hydrogen.

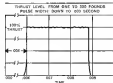
The Marquardt Corporation today provides the aerospace industry with one of the most extensively documented records in the area of space propulsion controls systems and components. Be it part or package, Marquardt can prove a record of performance which insures reliable products delivered on time and at optimum cost. For additional information contact E. L. Olinaga, Chief Application Engineer, Power Systems Division.

Engineers experienced in these or related fields will find it rewarding to discuss career duties with Marquardt—an equal opportunity employer.

THE **Marquardt** CORPORATION

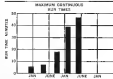
CORPORATE OFFICES: VAN NUYS, CALIFORNIA

AIRTRON • ODDITY DIVISION
• FORMAL DIVISION
• POWER SYSTEMS DIVISION



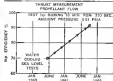
DOCUMENTED IMPULSE CAPABILITY

The above test represents one impulse test—demonstrating controllability of pulse width down to .003 seconds.



RADIATION COOLED THRUST CHAMBER RUN

Continuous 46 minute run duration of radiation cooled thrust chamber with R.N. and R.G. demonstrated a 90% efficiency with no degradation in performance during run and showed no adverse effects on the system.



DEMONSTRATED Isp EFFICIENCY

This chart shows thrust efficiency increase over slightly more than two years. Latest tests prove an Isp of 310 seconds, during a test effects run at 0.03 PSIA.

PT6 Exceeds Its Estimated Performance

Canadian Pratt & Whitney Aircraft Co.'s PT6 (T73) turboprop/turboshaft engine has been checked against estimated performance curves to 25,000 ft altitude during 20 hr of flight test while mounted in the nose of a Beech 15.

Engine performance at altitude was 1 to 2% above predictions.

Post consumption checks indicate the engine is exceeding predictions by 5 to 6%.

The test program now is aimed at screening 150 hr contribution for the light four turbine propeller in early 1967.

Flight engines now in the test program are totaling approximately 200 hr per month running time. So far, about 2,000 hr running time has been accumulated, plus another 5,000 hr on component development test.

The engine has completed its 20 hr endurance flight using its U. S. Navy Bureau of Weapons standard (NWB Apr 3, p. 35). Engine components were reassembled after the inspection breakdown which before the test and were run another 100 hr successfully.

Analysis tests performed in both Britain and Federal Aviation Agency specifications have been completed at the National Research Council facilities in Ottawa.

Tests established the feasibility of using a three nozzle, anti drag shield spray on the turbine inlet and nozzle. The spray used 2.5 gal/hr of diesel oil generated its own heat to 1.44 rail railburner specifications. Water flow during the test was 1.95 gallons/minute and the temperature was 66°C.

Two versions of the PT6 have been developed: the PT6A series turboprop engine with a two-stage planetary reduction gear for propeller applications and the 6B series turboshaft engine with a single planetary stage reduction gear for helicopter and V/STOL ap-

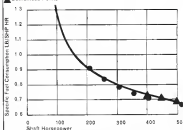


PT6 TEST DEMONSTRATES feasibility of reducing propeller for the engine's altitude by using an shield spray (top). Sea level static performance is shown in graph below.

Sea Level Static Performance

▲ Dynamometer Calibration

▲ Guaranteed Points



plains. The A series engine weighs 210 lb, 25 lb more than the B series engine.

The PT6 has designed primarily for helicopter and light twin use. Application in V/STOL needs requires a standard size, according to the company's present thinking.

One of the test engines was in at 15,000 ft for test firing on helicopter models and Beech is understood to be interested in possible light twin ap-

plies. Canadian Pratt & Whitney engineers say the engine could replace present 350-hp reciprocating engines.

The PT6A2 and B2 versions currently are rated at 580 shp and 500 shp respectively by civil standards and at 650 shp and 490 shp by military standards. Both versions have a growth potential of about 160 shp/shp.

The engine has a three-point mounting system with all three points in the same plane for conventional install-

tion and only Fenwal can tailor you an objective relation to your fire and overhead detection needs.

Why? ... because Fenwal is the world's only manufacturer of all three types of aircraft fire and overhead detection systems.

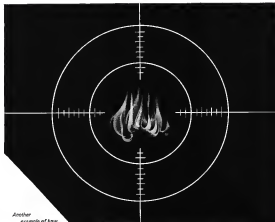
By talking to a Fenwal engineer — right at the design phase, he will make with you in helping you to specify the right system to meet your detection requirements.

Suppose your requirements call for *Fast Fire Detection* — you can rely on Fenwal because there are more Fenwal Fast Fire Detectors in flight operations than any other detection system.

If your requirements call for a *Continuous Fire Detection System* — just too, Fenwal can fulfill your needs because Fenwal manufactures the only aircraft sensing, non-sensing type of continuous detection.

Nevertheless! Only Fenwal can offer you a variety of non-sensing approaches, and recommend the one best for you.

It makes sense to talk to Fenwal first concerning fire and overhead detection needs — at the design phase. A Fenwal engineer can help you solve almost any in-flight detection problem. He has the experience and the complete line of products. For information on how fast a Fenwal engineer can help you — write Fenwal Incorporated, 1221 Pleasant St., Andover, Massachusetts.



Fenwal

DETECTS TEMPERATURE ... PRECISELY

PT6 Sea Level Static Ratings

(as of September 1967)

PT-6A	shp	rpm	Max. alt.
Altitude	200	2,000	15
Max. continuous	200	2,000	15
Max. alt. rated	200	2,000	15

PT-6B	shp	rpm	Max. alt.
Altitude	200	2,000	15
Max. continuous	200	2,000	15
Max. alt. rated	200	2,000	15

PT-6C (as of September 1967)

Altitude 200 shp 2,000 rpm 15

Data Exchange Program Yields Results

By Bruce Miller

El Segundo, Calif.—With various Data Exchange Program (IDEP) data, a three-year effort to eliminate unnecessary duplication in component part testing by exchanging reliability data among helicopter manufacturers and users, reports are starting to appear. The program is beginning to yield tangible cost and time savings for many of its 85 or more participating organizations.

At the same time, the number of reports being exchanged in the program with users, the number of its participants and the services provided by the program are growing too. In addition, more IDEP products are being adopted as standards, as a step to speed inclusion of independent test control and information distribution, according to Martin Berke, who coordinates the program here at Aerospace Corp.

In the IDEP program (AW Jan 21, 1980 p 47; Feb. 13, 1980, p 79) participating companies submit copies of test reports on component parts to one of three respective service data centers (the Air Force Ballistic Systems Division/Space Systems Division, the Army Ballistic Missile Agency, or the Naval Ordnance Laboratory, Coronet). The reports, covering component parts—ranging from individual components to larger interchangeable parts such as ported cannons—are summarized in cards. Highlights of results along with test conditions are given. Maximum steps of the original reports are attached to the summary card. The data centers then interexchange master copies and make copies distributed to its contractors copies of the summary card.

Collate Specific Cases

To find and collate specific cases in which IDEP helped its participants, Berke recently conducted a survey. He telephone contacts of about 28 of the more active contractors handled by the Air Force Ballistic Systems Division. He is also people conducting the program at three participating companies amount for \$19,000 in savings. Berke figures his survey cost only a third of the active accounts of IDEP reports and that specific quantitative claims were required to only about a third of the reported amounts. He also believes the specific cost amount for roughly half of the actual cases of each organization were the same for specific reports were a currency note. Extrapolating from these figures and assumptions, Berke estimates the pro-



INTEREXCHANGE DATA EXCHANGE PROGRAM

of reliability reports circulated among over 80 ballistic missile and space contractors from limited line and on the right indicate shows number of reports in a function of data and number of reports fed into the program monthly (heavy black line with dots and left column). Individual service contractor monthly contributions are represented.

gram has saved its participants about \$170,000.

The more available number of reports during the year preceding the telephone survey rose about 47% and less than half of the participating contractors were set up in electronic use the reports. In the future, both the more number of circulating reports and the number of companies using them will rise. Between August 1982 and August 1983 a plateau of 1,800 reports in IDEP circulation is expected to be reached based on the present rate of transmission of reports into the program. This would mean that the present savings estimate is based on only a third of the potential available reports in circulation when the program gets full swing. The number of reports will stabilize at about 1,800 in the older, dated reports are removed from circulation.

In the end of this past September slightly less than 1,800 reports were available in IDEP. The rate at which they were being submitted to the program rose to 740 a month in September. At this rate, Berke estimates the

total IDEP report bank now size to 1,800 to 1,900.

IDEP is expanding in several ways. It is now exchanging data with the Navy Guided Missile Data Exchange Program, implementing data previously obtained from Polaris contractors. In addition, the Army Ballistic Missile Agency is now handling Army Rocket and Guided Missile Agency contractors. Several National Aeronautics and Space Administration contractors recently began participating and within the Air Force there is a working arrangement to handle some of Electronics Systems Division's contractors.

Avoid Duplication

In an effort to decrease with duplication in the planning of new tests among contractors, a per IDEP (IDEP) program recently was established. Under IDEP, contractors submit data to the exchange program plans of forthcoming tests and those under way. This gives other program participants an opportunity to cancel or modify their own tests if they learn other companies are conducting similar tests. Because also

REPORT:

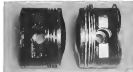
Shell reports on three new lubricants that improve aircraft operation—and two new developments that improve aircraft service



Gulf Stream 15 is the first piston turboprop aircraft to use Shell's new 100W turbine oil. It's the first piston turboprop aircraft to use Shell's new 100W turbine oil. It's the first piston turboprop aircraft to use Shell's new 100W turbine oil.



New Shell-Gulfstream 15 is the first piston turboprop aircraft to use Shell's new 100W turbine oil. It's the first piston turboprop aircraft to use Shell's new 100W turbine oil. It's the first piston turboprop aircraft to use Shell's new 100W turbine oil.



First overhaul of a Gulf Stream 15. These prices were pulled from engines of this aircraft after 1000 hrs. Left piston cost \$1000. Right piston cost \$1000. Right piston cost \$1000.



First overhaul. New 100W turbine oil. Both to Shell specifications can transfer 10,000 gallons of turbine fuel in 13 minutes. Low oil viscosity permits safe refueling. Cut refueling time to the bone.



Now over 100 Shell service stations. Map also shows their locations. Nearly 100 Shell dealers have turbine fuel in stock. You can change fuel lubricants and services on Shell's new Gulf Stream 15.

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- ☐ Turbine Fuel Lubricants
- ☐ Credit cards

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missile or meteor shower?

If it were a missile, the time for intercept would already be past. Your anti-missile missile should already have been to the point to produce the destructive consequences. An essential part of an anti-missile detection system is an advanced multi-function, phased array radar-computer complex. This complex would protect the long range detection and selection, tracking and labeling of vast numbers of space and air-craft objects—encompassing satellites, space

vehicles, orbital warheads and debris. Armed to detect a radar stream with beams which can be electronically steered in terms of both angle and programming of an advanced computer. With such a radar it is possible to detect and track hun-

dreds of targets while continuing to search for additional threats. Because this type of radar stream makes no such lateral motion, it can be easily hardened to withstand the heat and blast of a nearby nuclear explosion.

Hughes has pioneered, designed, developed and produced many multi-function, phased array radar computer systems for military operational use. It's better we are the only company that can make this statement.

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available contracting officers to improve individual test plans. IDIEP is essential to show the gap between the generation of a test requirement and the distribution to and shift of project resources to test a contractor's test results.

Practically IDIEP handled only specific pieces of hardware; predominantly more components or parts, but it is now, starting to include other types of reports. Among these are ground process reports and other existing behavior of materials in a vacuum, seating of components and relative effects on components and materials. IDIEP also is attempting to formulate final conclusions of high reliability specifications to ensure duplication in this area. It would eliminate corporate high reliability qualifications after they have been coordinated with the vendor. Eventually there is to be coordinated by a DOD-Darrell type activity.

Some Overview

In one report program, 98 specifications are placed into a master lower rate 17 items were generated. Between them, two there may be some overlap, and certain items in local and test philosophy, area of components and conditions effect. In interchanging specifications, overlapping can be avoided. In such exchanges IDIEP is not attempting to wrap the authority of a Department of Defense authorized group implementing the Darrell proposal, but rather is trying to meet in the interim period.

A further indication of the growing acceptance of IDIEP, its principles and practices is reflected in their adoption. In several companies for no longer products. Companies such as Radio Corp. of America, General Dynamics/Astronautics, Martin Marietta, Librascope, Lockheed and Sperry adopted parts of IDIEP's format, including, standardizing and other procedures to facilitate their own in-house and subcontract test control and information distribution, according to Burke.

A few specific instances of savings attributed directly to IDIEP and cited by IDIEP coordination in the recent telephone survey are:

- **Company A** eliminated 15 items on 62 types of transistors, two of which were never used; tried, on the basis of two reports it received through IDIEP. Extraneous was less than of such not at \$1,500 indicates Company A saved a total of \$19,500. Three other IDIEP reports enabled this same organization to cancel five items on heavy scope parts at a saving of \$7,500.
- **Company B** discarded planned tests on 73 each of 62 types of transistors at a material cost of \$41,500 after consulting IDIEP reports.
- **Company C** did away with an average

of one major qualification test a year for a total savings of about \$10,000.

- **Company D** will save 100 lbs by eliminating two tests which another company reported it is planning through IDIEP. At \$10 per hour labor cost, Company D is saving \$5,000.
- **Company E** discarded eight redundant tests, saving \$1,676 per test, for a total of \$13,280.

Other instances of savings provided by IDIEP to which no specific dollar value can be assigned include the following:

- **Company F** cut the size of samples in a test of semiconductor tests.
- **Company G** contacted its vendor and recommended a test plan to agree with the known and potential weakness of a specific component.
- **Company H** established a failure analysis station on an IBM program.
- **Company I** initiated standardization after it learned through reports through IDIEP participants that the glass seal on a given component might crack.
- **Company J** eliminated an undesirable connector type in a ground support equipment package for an aircraft vehicle.
- **Company K** was assisted in the selection of parts and vendors.

One major incentive arising in IDIEP events over the vendor's opportunity to comment or challenge individual component reports before they are included to IDIEP members. The report serves only, but have not accepted reports to show them to readers before reference to IDIEP. The vendor not only and decision of having this reviewed. This step is useful again in that it does not to obtain the vendor's consent to the report, but to give him an opportunity within a stipulated period to offer explanation, remarks which can be appended to the contribution to the report. This gives the reader a chance to detect his product and the contractor an opportunity to obtain some desirable feedback without diluting the effectiveness of the report to IDIEP.

Refined Activity

In a related activity, IDIEP is preparing a specification on how to write test reports and what to make a final report. These must done of effort in the selection test selected for the final.

The IDIEP program is designed to produce these functions:

- **Inform contractors** when tests they schedule or conduct are being drafted because often are planning compatible tests, have added identical parts or components types to their test schedules or a change in the requirements for the part area.
- **Give prospective tester a chance to**

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Pioneer-Central Division



West Coast Sales & Service: Burbank, Calif.
Bendix International Division 2811 42nd St., New York 17, N. Y. Eastern Office: 1411, Rockwell, Quebec, Canada

revive projected tests in tests in process to avoid duplication.

• **Coordinating information on testing requirements** at specific parts area, generating decisions to be held during construction before tests to encourage cooperative planning.

Construction and agencies now participating in IDEP can also work through PIDEF. In September, 57 airports were established by PIDEF participants. While this is only a small computer with what would be necessary for it to be a success, the program is only now getting under way.

According to the PIDEF plan, a Test Manual or In-Process (TIP) form for each test is submitted by the contractor.

Two copies are sent to the service data distribution center where they are duplicated on overheads and copies distributed to interested participants. Less than a week elapses from the time a report arrives at the service center and is distributed to participants. This shows remarkable time off the period required in IDEP where the process of manufacturing a complete test report slows the distribution process.

As an incentive that TIP cards are brought up to date, changes, including tags or corrections are included immediately on TIP cards which expedite previous ones are assumed. The information offered on TIP cards ultimately would be contained on IDEP summary cards.

The volume of TIP cards is expected to be about 100 per week with roughly a fifth of the changes and corrections resulting in the original card. The total file may average 1,000 cards.

50-131 FILTER CENTER 50-132

► **Transistor Builders Adopt "Borehole"**
Increasing numbers of transistor manufacturers are adopting position of mounting the device under power, somewhat at elevated stress, prior to shipment to avoid not available but another—protective penicillin need to be tested. The transistor has been exposed to the second Semiconductor Reliability Conference in Washington. General Electric's General Ziegler said GE tests indicate that a 45 hr. high stress exposure at elevated temperature and voltage followed by two weeks of human at normal stress, appears to weed out most of the potentially unreliable devices. John H. Jones of General Instruments reported that 100 hr. of human at elevated temperature weeded out 95% of the potential failures. James N. Parr of Transistor Builders indicated the hypothesis that a bath of transistor may contain a fixed number of potential failures and all of which can

be detected in advance of shipment by high-stress tests.

► **Pressing Thermo-electric Material**
Bell Telephone Laboratories, scientists have developed new thermoelectric material using lanthanum-antimony which has figure of merit of 0.005, much better as good as any other known material at low temperatures of around 90K. The organic material will find use in Peltier cooling surfaces than in a thermoelectric generator.

► **Transistor Sales Climb—Transistor sales for last eight months of the year totaled 117 million units, an increase of 52% over the same period last year but dollar volume for same period was \$230 million an increase of only 1% over 1960, according to figures released by Electronic Industries Assn. The rising cost volume with greater, so increase in dollar volume explains why the semiconductor industry is still depressed. Revenue for last eight months totaled 240 million, a drop of about 9% from 1960, with dollar volume down proportionately. Average price per transistor was \$1.70, down from \$1.85 for average price per unit.**

► **Soviet Union Produces 20 Mega-Watts—Manufacture of the high-power tube set in the Soviet Union can be traced from recent U. S. translations of a Russian article published in 1959 which describes a vacuum tube capable of producing 20 megawatts peak power at 10 cm wavelength. The Russians freely admit an American Union as the basis for their development, but say that changes in design made by Soviet scientists resulted in a tube with considerably better efficiency, reliability and service life.**

► **Semiconductor Industry Concerned—Semiconductors manufacturers view the current Justice Department Federal Grand Jury on indictment (AW Aug. 21, p. 26) of semiconductor device plant, as more seriously than cause of their own to avoid. For one thing, the exposure of such an existing top quality legal counsel and the time and effort required to gather subpoenaed information at a time when the entire industry is cutting back in the home will be staggering. For another, much of the subpoenaed information, which also includes individual desk calendars, doesn't exist. The industry expended its quality and product demand is required to supply that demand, which frequently was not kept. The investigation likely will center on aspects of price fixing in the 1957 to early 1960 period.**



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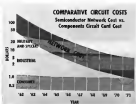
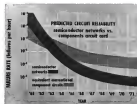
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RELIABILITY of semiconductor networks should equal that of conventional construction by 1965 then quickly surge it, according to Texas Instruments. Curve at right shows low cost of solid-state circuits (semiconductor networks) as expected to be competitive with conventional construction for multiplicity military production by 1964, and become less expensive within five years.

Semiconductor Network Gains Predicted

By Philip J. Klaus

Washington—Micro-miniature solid state circuits fabricated on thin, wafer conductor crystals should match the reliability and cost of conventional construction techniques within several years, then pull ahead in subsequent years, a Texas Instruments, Inc. official predicted here.

P. E. Hagerty, president of Texas Instruments, also revealed new details of the techniques used by the company in the fabrication of semiconductor networks, a a phenomenon which now exists in government and industry laboratories.

In addition to a two digital computer built for demonstration purposes (AW Oct. 30 p. 81), Texas Instruments is

applying the new semiconductor networks to a pulse clock, multi-state (PCM) telemetry encoder under contract to the Electronic Technology Laboratories of the USAF's Aeronautical Systems Division, Dayton. The resulting encoder is expected to weigh only 1/15th as much and occupy only 1/50th the volume of an encoder built with conventional miniature components Hagerty said.

Comparative studies indicate that a computer programmer for space vehicles, which now occupies a volume of 220 cu. in. and weighs 7.5 lb. using the best of conventional techniques can be built in a volume of 1.5 cu. in. and weigh a weight of only 1.5 lb. using the new semiconductor networks. Similarly, a digital computer for guidance of an air-

to-ground missile which now weighs 115 lb. and occupies 1,100 cu. in. could be built to weigh only 5 lb. and occupy only 50 cu. in., company studies indicate.

The new Texas Instruments Series 51 semiconductor networks, providing an efficient digital computer logic function, are now available in quantities of a few hundred. Hagerty said the company plans to introduce the first of a new Series 51, providing analog functions starting early in 1963 with the full line available by spring. This will include a low-level audio amplifier, operational amplifier, d.c. differential amplifier, video amplifier and a 1 to 3 watt power amplifier.

The two Series 51 logic networks now available, including a flip-flop counter,



SPACE AND WEIGHT SAVING inherent in new semiconductor networks is illustrated by these two flip-flops (left) which perform same function in conventional circuit board. Photographs of two solid-state devices prior to encapsulation show components with interconnections. Six different logic functions are made from same basic circuit by differing interconnections.

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African Carrier Lists Fiscal 1961 Profit

Central African Airways, based in Southern Rhodesia and having 700,000 passengers, declared a fiscal 1961 net profit of \$253,226. The profit was earned despite turbulence on the continent, the airline's withdrawal from Zambian service last October, and the grounding of its Viscount aircraft due to wing modification.

Profit was announced by R. M. Teylo, chairman of Central African. He said that the airline engaged "in technical requirements" for the year ahead despite the fact that Central African Airways' routes continue to be unpredictable, e.g. flights into Botswana and Swaziland.

In the 1960-61 fiscal period, Central African carried 701,004 passengers according to the company, an increase of 22.54% or 15% over the previous year. In the same period, the carrier handled 2,110 tons of freight, an increase of 14% over the previous year's figure. Growth of air mail, according to the company, "was disappointing."

Teylo attributes much of the parent company's increase in the airline's increased activities in the marketing of "expensive, all-inclusive scenic tours to the East Africa and Natal coasts." These and increased tours to South Africa are the major reasons for the increased passenger activity, according to the company.

Another recent Central African maneuver has been the introduction of Douglas DC-7B skybus service between Salisbury and Johannesburg.

Airline's fleet consists of Douglas DC-7B, de Havilland Beavers and Viscount 740Ds. recent additions include:

- Flight into northern Rhodesia with DC-7B and Viscounts.
- Service to Nyamaland where Viscounts are being phased in to replace DC-7B.
- Southern Rhodesian flights with an improved timetable.

New Offerings

Rothrock Electronics Corp., Costa Mesa, Calif., engaged in the development and manufacture of electronic units for remote control systems designed to control the take-off and operation of unmanned aircraft and missiles by radio and the manufacture of sensitive automatic and semi-automatic alarm timing circuits for the defense industry. Offering is 300,000 capital shares, 30,000 shares by the company, and 270,000 shares in the private market. Of the company's proceeds, \$688,000 is for back loan payment.

FINANCIAL

Precision Measure Corp., Mills, Mass., engaged in the manufacture of specialized microwave components for radar detection and missile guidance systems and communication systems, and specialized components for commercial and aviation jet aircraft engines. Offering is 165,000 common shares at \$10 per share, \$15,000 shares by the company, and 150,000 shares in the private market. Of the company's proceeds, \$142,990 will be used for the retirement of financial indebtedness, \$199,400 for the retirement of current accounts payable, \$150,000 for additional technical personnel and for research and development projects in the microwave field.

Aimodels, Inc., Anaheim, Calif., engaged in the development and manufacture of high speed electronic data handling equipment, range finding equipment, and standard electronic products. Offering is 200,000 capital shares for public sale. By the company, and 625,000 outstanding capital shares owned by Aimodels, Inc., the company's principal stockholder, for subscription in Aimodels' common stockholders at the rate of one thousand shares for each Aimodels share held. The company's proceeds will be used in part to retire short term bank loans.

Acoustical Research, Inc., Long Beach, N. J., the company has acquired all the stock of Crig Instrument Corp., which has been engaged in research, development, design and manufacture of electrical, electronic and mechanical equipment and instruments for petroleum and the government in the geophysical field. The company proposes to engage in research, experimentation, development design and manufacture involving processes and instrumentation in the fields of acoustics, meteorology, atmospheric phenomena, environmental engineering, weather modification and control, medical electronics, etc. Offering is 100,000 common shares at \$3.50 per share. Proceeds will be used for research and development, new equipment and machinery, increased inventories, personnel, sales and advertising.

Regen Precision Industries, Inc., North Arlington, N. J., engaged in the manufacture of precision parts, components, assemblies, and subassemblies for the aerospace, electronic, marine and aircraft industries. Offering is 100,000 common shares. Of the proceeds, \$168,000 will be used for tools, equipment and machinery for a plant addition, \$40,000 to satisfy loans payable.



Speys Tested on Vulcan V-Bomber

First flight of Rolls-Royce Spey turbojet engine was made in the Avon Vulcan V-bomber. Two Speys are mounted in the aircraft's outboard engines are the Vulcan's second Bristol Siddeley Olympus powerplants. Spey will be used in the de Havilland Trident three jet transport, and the BAC 111 twin jet transport; military versions will be installed in the Blackburn NA 59 strike fighter.

MISSILE ENGINEERING

Transportable Bomarc Proposed To USAF for Flexible Deployment

Beeing Co. is proposing a transportable BM-90B Bomarc, capable either to USAF for increased defense capability without the additional high costs and long lead times of fixed sites.

Major areas behind the proposal stem from the 30-month lead time required to expand an existing site or to build a new one. Boeing estimates 26 months for construction time plus an eight to ten months for take-ready time on the finished site. Costs of sites vary widely, depending on local labor market, soil conditions, and other factors.

The proposed system is that this long lead time can be traded for equipment which requires no more than a nine-month lead time for delivery of cranes and trucks, complete with launchers and all support equipment.

Standard Erector Launcher

The proposed system is based on the use of standard construction truck trailer chassis. All equipment used in fixed site Bomarc shelters is either relocated on the trailer or repurposed in small vans. Each trailer is mounted on its standard tractor-launcher at the rear end of the trailer.

Cranes, positioned from the normal centerline of the trailer over the Bomarc wings and tail surfaces. Thus, cranes work within the net height of the trailer beyond those standard for current highway systems. However, as

ported across more leads of even greater dimensions over the open roads, and Boeing foresees no problems in high way transport.

System is also designed to be transportable, but the 15-ft wingspan of the Bomarc probably would make it necessary to dismount wings for travel by air or other the current Lockheed C-141.

Increased flexibility of the Bomarc unit itself would be obtained in a number of ways with a transportable system. Strength of its existing fixed site which currently has no other capability can be increased through deployment of additional wings on closed ground nearby.

Areas currently unsuitable for Bomarc transfer in which the fixed-site installation is not completed, could be covered by transportable elements on a temporary site.

Bomarc operations could be moved from site to site to meet a changing threat without the need to build a fixed installation.

Finally, the system could be moved into a remote region of the world where air defense would be needed to meet the problems of local conflicts. After the situation had calmed down, or had ceased to be a crisis, the Bomarc units could be moved out or reduced in strength without having to abandon airports or facilities of large value.



BM-90B missiles are shown in loading model mounted on standard tractor-launcher at rear end of trailer. Trailers and small vans would contain entire weapon system.

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ACCLIMATING MAGNETIC DRUMS TO SPACE

Giant strides have been taken in developing the magnetic storage drum for ground and airborne electronic systems during the past decade. Equally important strides remain to be taken before magnetic drums can be confidently committed to space projects.

Litton Systems engineers who have contributed significantly to the improvement of the magnetic drum—a key element in Litton's ground

and airborne electronic data systems—are now preparing that highly essential component for space vehicles. Problems they are investigating include distortion created by the absence in space of the boundary-layer lubrication phenomena, the static behavior of electrons at hyperviscosities, and the effects of vibration caused by post-launch acceleration.

Aspects of these problems were recently investigated by Litton engineers who subjected a Litton-developed, 8-inch lightweight magnetic drum and associated contact magnetic recording heads to a series of high-vacuum vibration and altitude tests. Drum and heads (without helium lubrication) were operated at simulated altitudes in

excess of 300,000 feet and vibrated at frequencies as high as 50g rms (basewidth 20 to 2000 cps).

Primary objectives of the high-vacuum tests were to determine: (1) Tendency of heads to bounce on drum surface under shock or vibration. (2) Relationship of recording signal level and equipment wear to contact head pressure. (3) Dependency of head flutter on air density.

Both drum and recording heads operated without loss of information during these tests, indicating that additional tests to prove the feasibility of magnetic drums, contact heads, and associated electronics for outer-space applications are fully warranted. The next series of tests will be designed to determine the effects of cosmic radiation on electronic and mechanical equipment. Still other tests will then be conducted to study the performance of equipment in the temperature extremes of space.

Litton has successfully developed and is now producing complete data systems incorporating magnetic drums storage and retrieval subsystems that use contact heads for reading and writing digital data. Litton engineers have little doubt that what they have accomplished for ground and airborne systems, they will also be able to do for space systems.

Electronic engineers intrigued by problems and solutions of this sort and anxious to negate or prove out Litton approaches are invited to write, phone, or visit Constel Des Cobles, Litton Systems, Inc., Computer Systems Laboratory, 5509 Canoga Avenue, Woodland Hills, California. Or telephone DIamond 6-4900.

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BUSINESS FLYING

Cessna Optimistic Over Sales Prospects

By Evert J. Bolten

Wichita, Kan.—Cessna Aircraft Co. stands a good chance of setting a record in business aircraft sales in 1962. Senior Vice President Del. Rowland stated during the company's annual international distributor-dealer meeting here last week. The projected business would top Cessna's previous mark, set in 1960, when it delivered 576 1 million worth of conventional aircraft and space.

Even should the U. S. economy suffer the adverse effects in mid-summer that are predicted by some U. S. economists, Rowland said he was confident that Cessna business aircraft sales will still exceed 1961's volume by at least 10%.

Management's bullish attitude for the company's prospects has been expressed by stating more than twice the money for expenditures of its 1962 line than it has spent in the past in one previous year, he added. Although he declined to disclose specific figures, he indicated that development costs for next year's line can just under \$10 mil line.

Confident view of 1962 business expressed by Cessna top management is also of particular significance to its numerous suppliers with whom it shares approximately 35% of the cost of its products.

Discussing new product and availability developments, Rowland noted that:

- Formal announcement of acquisition of Cessna has concluded with the Argentine government for production of the company's business and utility aircraft in that country can be expected very soon. The company has been conducting negotiations for two or three years and indications are that this project will be under way as a few months the initial type being the Model 172.

The arrangement marks the first step Cessna has taken in its long-range plan to have its airplanes built wherever foreign markets and competitors warrant the move. An Radiana pointed out, Lockheed Kestrel already has moved into Argentina and two Boeing companies have indicated interest in the Latin American area. One of the latter has signed an agreement for production in the Southern Hemisphere, but has not yet made a move. Although Rowland declined to name companies and areas, the countries involved are Argentina and Brazil and one of the companies is Mooney-Saunders which is industry



CESNA 150 for 1962 has redesigned wing tips, more gear suited air.



BEVLAK, above, has new cowling front control speed pedals. Gross weight is up 200 lb. Optional. Early test, below, increases capacity of Skylane and Skylark to six persons.



observed, familiar with the regulations, and plans to build approximately 60 Rollin three-place lightplanes in Leno, Illinois.

• **Excellent progress** is being made on the new two-place Model 318 Skystar, which features forward air seating of its 150 hp Continental D3-900-A engine. The prototype has completed 100 hr of flight testing of which approximately 25 hr have been on the production configuration, which features added vertical fin and elevator area to improve its handling characteristics and improvements in engine cooling and airflow around the fuselage. The Model 319 is expected to complete one year trials in the next few months, prior to starting its formal Federal Aviation Agency certification tests and is expected to join the company's product line next year.

Because of its four-place configuration, Federal Aviation Agency still is studying the problem of whether it will require a single or multi-engine pilot rating. For Skystars pilots, although Cessna has submitted a proposal to the agency requesting that a single-engine rating be considered.

• **Future aircraft** studying plans currently are based on steady additional

models lighter than its current Skystar. Feeling is that greatest penetration of the civil market will be in a four-place aircraft in the \$35,000-class and that this will have to be a practical helicopter embodying considerable lighter and not a stoppied-down machine. Renda noted. Also needed is a two-place version in the less than \$10,000 bracket, with some emphasis on simplicity, he noted. The company has made and is continuing to make design studies on a large variety of configurations covering these items, wing shapes. Renda stated. That could affect a geographic or helicopter.

• **Aggressive airplane**, specifically he said for this market, a stunner Cessna study project. Renda stated that the company thought a second half year that they had reached the point where they had a design ready, but after further consideration, felt that it did not add enough "in breath" to the line of work that the company is seeking in this field.

• **No decision** has been reached yet on a full design for the 6 to 10 seat heavy twin project planned for introduction in the field later (AV News 1968-1), although detailed planning has been completed on some or eight de-

signs in this class. Cessna still feels that this will have such an airplane ready in 1969. In addition, according to Cessna, that the product will have to sell for about \$750,000 at most, fully equipped, to be feasibly received. As to sales penetration, Renda estimated that there is still need to be learned about these markets and that the aircraft cost "about \$400,000", is a major handicap of penetration.

Three models comprise Cessna's business aircraft fleet for 1969, including there, to me the Model 110C, the Skylark and the forthcoming Model 330 Skystar, the single-engine Model 210, 182 and its de facto counterpart Skylark, the 172 and its de facto version Skylark, the 180, the 185 Skystar, the 350 and the Skylark.

With its main models on the line, the company feels that it cannot develop sufficient production facilities to provide for all of its distribution dealer companies with a complete inventory immediately—who in some cases there is yet a full inventory among some dealers at 1969 airplanes and in a recent Cessna sales survey has indicated that a relatively unmet demand of dealers in new models staggered over the next few months.

Models 190, 172 Skylark, Skylark, Skylark and Skylark will be detailed at Cessna's recent meeting. Models 180, 185 Skystar, 182 and Skylark will be revealed to the public Jan. 5 and Model 180 and 190C are scheduled for an earlier Feb. 2.

All models but the 110C were projected during the meeting here. The reason given for withholding the 110C was that the company in Tulsa wants to go into the field with its development program to support a full-time promotion aimed at maintaining the vital customer interest in the future. Keeping one model under wraps until then may prove a bit uncertain, according to Renda, but a follow-up program.

Model Secrecy

Special precautions are being taken by the company to maintain secrecy of the features of new aircraft prior to their public showings. This year the company is modifying its Tulsa method of new models from the factory to the field prior to their public showings using a Skyway, owned from the automobile industry.

A special release request covering, approach of light duty aircraft, will be needed in such new model flow to the field, according to the company and its distributor. The result of the distribution of the airplane will be the first flight record in this but, the major attention being asked will be in the

delivery organization and the bags being removed only for the public showing. Bags are covered to the airplane's ground configuration, but will not reveal specific details.

Initial buyers from the factory of 1969 models by distribution and dealers would some 300 airplanes. Highlights of the first models covered publicly by the company include:

• **Model 172 and Skylark**, which has a gross weight increased by 50 lb. and one, for a new gross of 2,250 lb., providing an increase of useful load for the 172 from 940 to 990 lb. and for the Skylark from 880 to 930 lb. Airplane performance is increased through aerodynamic cleanup, reducing newly developed, standard plastic wingtips having membrane lights lined in and medium-size propeller system. Wing tips and spinner are interchangeable in Models 180 through the 185 series. The 190C Model 172 is priced at \$9,995, up \$100 over last year's version and the Skylark is priced at \$11,995, up \$115.

• **Skylark features** a conventional McCauley C21-180 propeller, specially designed for that engine, using hydraulic oil from the engine system. Other changes include the new wingtips and spinner, interchangeable control flaps on the engine cooling and magnetic fuel-line pipes replacing the former thermal-type pipes. Gross weight is now 2,450 lb., up 100 lb. from the previous year and the useful load is up 85 lb. The airplane now sells for \$16,125, an increase of \$375. The former comparison Model 175, which was the standard version of this airplane, has been dropped due to customer preference for the de facto version.

• **Model 180** is a single-place lightplane but has more landing gear clearance than that of the center line to improve



how to drop a pilot straight up...

When you talk about ejecting a pilot, jetting out fuel tanks, weapon pods, or jetties, you're talking about just one of Gemco's specialties — CAD (forwardly actuated devices). ■ Gemco CADs furnish the necessary kick for safely separating man-made from today's high flying aircraft. Gemco devices are used for such assignments as in-flight separations of rocket pods, missile pylons or propeller stages and launching air to air and air to ground weapons. ■ Some of Gemco's current production includes the manufacture of pylon tank racks for the F-105 fighter, as well as special devices for the F-35, the A-1, the F-101 and F-104. ■ The capabilities and proved ability of this subsidiary of the HUPP Corporation have been developed beyond compare. Gemco has the know-how and skills for intricate sheet-metal work, precision mechanical assemblies, highly refined electronic mechanisms, etc. Gemco has the engineering and manufacturing facilities to produce complete systems — everything from electrical wiring to weapons to aircraft components — plus advanced aircraft and missile guidance and propulsion assemblies to turn them into practical machines. GEMCO, INC., a subsidiary of the HUPP Corporation, 2328 Steiner Avenue, Los Angeles 25, California.

and speed the forces of gravity

GEMCO



Hiller 12E Downwash Aids Forestry Program

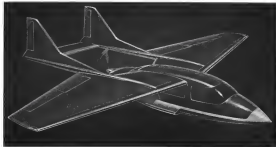
Forest trees, designed to kill unwanted plants and give smaller trees room to grow at faster rates, are being used in the 12E Downwash. The machine is 12 ft. long, 12 ft. wide and 12 ft. high. It is powered by a 12-hp engine and has a 12-hp pump. It is used in the forestry industry to kill unwanted plants and give smaller trees room to grow at faster rates.

Cessna 1961 Sales Drop

Reduced commercial and military sales for 1961 resulted in total sales just over \$87 million by Cessna Aircraft Co., Wichita, Kan., for its fiscal year ended Sept. 30, compared with \$105 million the previous year.

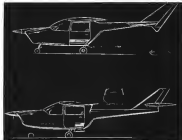
However for the year just passed sales approximately \$1,250,000, or 84.6 per cent compared with \$1,277,000 or 82.24 per cent the previous year.

In announcing approval of the 1962 25th quarterly dividend, payable Nov. 21 to holders of record Nov. 6, Cessna president Oliver L. Wallace reiterated the falling expressed by other top officials at the company's recent distribution date. He noted that 1962 should be a good year and considerably better than 1961. He noted that more than \$4 million in military follow-on business is expected to be received officially in the next few weeks.



Push-prop, single-engine, twin boom pusher business aircraft probably would have a piston engine. Cessna at present leans toward turboprop designs, with propellers driving axially rotating conventional engines.

Cessna Studying Radical Business Aircraft Designs



High-wing design, similar to Model 210, features deep steps in door, then tail boom.



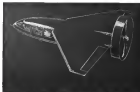
Twin-tail boom design models single engine. Left and twin-engine designs. Twin-engine craft features bicycle gear with outriggers.



Radical designs on business aircraft, leaving aside the pusher engine and boom-mounted turboprop configurations, are being studied by Cessna Aircraft Corp.'s engineering department. Also under study are a number of other-wing aircraft, including both pusher and conventional rotorcrafts. Design sketches were displayed during the company's recent distributor-dealer annual meeting in Wichita, Kan. Most of the sketches apparently were "blue sky" thinking, rather than attempts at definite projects, but some drew considerable interest, such as the Model 210 and Model 215, which is now in flight test. The design is based on Cessna's first airplane, built in 1911, and was aimed at showing the program in private plane design made in the 1930s when the company's founder put together his first machine, patterned after a Blériot design.



Turboprop, low pusher helicopter, with engine mounted on rotor gyro, is one of several other-wing designs under investigation. At present, no engine are suitable as push-prop Cessna designs.



Delta-wing pusher with shrouded propeller is a radical approach to a heavy single-engine business airplane, among possibly six. Two-yr. right has swept-mounted engine, pusher turboprop, and T-tail.



Pylon-mounted engines and wing are evident in above design studies. Aircraft at top right has wing on pylons.



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NORTHROP

SAFETY

Pilots Take Firm Stand on Safety Margins

By David H. Hoffman

Changes for Large Pilots Area, annual safety forum here, declared that an intensified Federal effort to perfect sophisticated devices and procedures for increasing the air traffic control system's capacity without compromising its safety has won the solid support of U.S. airline pilots.

ALPA, the pilots' representative at aviation's three-day forum, made it clear, however, that pilots were strongly opposed to any new procedures that might reduce safety margins purely for economic or political purposes. The objection, pilots told Airlines Week, might apply to other attempts to lower terminal landing minimums and to some other aircraft procedures that call for steep climbs at reduced power.

Control air safety changes for the most evidenced that concern seeking Federal Aviation Agency approval to land their jets with ceilings as low as 100 ft. and visibility as low as 1/4 mi. should first install new equipment. Be they with precision landing, lower than 100 ft. or visibility less than 1/4 mi. their present minimums aircraft should be equipped with dual autopilot systems and dual approach complex or flight di-

rection, said J. B. Cross, president of the National Aeronautics Administration. Cross, agreed that the problem of limiting aircraft noise has been solved more by pilots than by designers. William Littlewood, vice president-engineering research for American Airlines, added that U.S. carriers pay 95% of their total aircraft fuel bills just to reduce aircraft noise levels by about 12 decibels. But he too agreed that "in some cases, more is the basis of a safe operation."

Overwhelmingly, airline pilots here endorsed FAA's continued on expanded equipment to reduce landing minimums (AVT Oct. 21, p. 77) as a prerequisite for the granting of lower minimums.

The pilots generally concurred that the 70 approved new checkout procedures now in use were not inherently dangerous. But they also said that those procedures pushed safety to its outer limit. According to Capt. Hans Clark, control air safety chairman of Trans World Airlines, a Boeing 707 appeared to climb at V₁ (first climb speed) plus 10 kt. or within 15 kt. of stall speed before when turned with 15 deg. of bank. "We are advancing, we will go to further," an following air route procedures that require aircraft performance. Capt. Clark told the forum. The problem of noise should be corrected on the domestic route and not in the cockpit, he said.

Saying that "we've gone as far as possible with noise abatement proce-

dures," J. B. Cross, president of the National Aeronautics Administration, agreed that the problem of limiting aircraft noise has been solved more by pilots than by designers. William Littlewood, vice president-engineering research for American Airlines, added that U.S. carriers pay 95% of their total aircraft fuel bills just to reduce aircraft noise levels by about 12 decibels. But he too agreed that "in some cases, more is the basis of a safe operation."

On the subject of how the flow of air traffic can be safely regulated in the future, Capt. Sam Smith, American Airlines' director of air traffic control, said that FAA now is convinced that it can move more aircraft from a given instrument runway under Instrument Flight Rules (IFR) than under Visual Flight Rules (VFR). Next summer at New York International Airport, Smith said, FAA will demonstrate its ability to increase IFR landing rates to about 30%, thus boosting runway capability to about 50 aircraft per hour.

Los Warren, deputy director of FAA's Air Traffic Management Service, and Joseph Blum, newly appointed director of the Agency's Aviation Research and Development Service, discussed various projects designed to



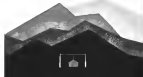
AW 650s Prepared for Delivery to BEA

First Armstrong Whitworth AW 650 Agency cargo freighter for British European Airways (AVT Oct. 5, p. 40) takes off from manufacturer's plant at Bitterfeld, Luxembourg. BEA has ordered three Agencies and will schedule them on European freighter operations in November. Airplane also has been ordered by Royal Air Force, and is used in U.S. Marine units by Helix.

population -



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classroom AIC terminals and enhance system skills. This said that current FAA plans call for the following:

- **Blanketing the entire U.S.** with two true control airports above the 41,000 ft flight level in Alaska, 1962. Next step will be the lowering of the positive control airspace above 23,000 ft, a move FAA hopes can be taken in the Oakland-Sacramento. Admittedly, this may mean 10,000 ft to three tons, positive control will be extended to cover all U.S. airspace above 23,000 ft except in Hawaii and Alaska. When necessary ground and airborne equipment exists, this floor will be lowered to 14,500 ft, a true continuous area of the commercial U.S.

- **Applying the principle of positive control to the airspace surrounding major metropolitan terminals.** Initial tests in implementing terminal area positive control has been taken at L. D. Washington, Washington, Md. and Atlanta where FAA may wish to establish the leading sequence of visual VFR and IFR flights.

"As the nearest possible time," Watts said, this service will be expanded so that all VFR pilots passing through a particular terminal area make their presence known to ATC. From this base, terminal area control will progress until a system is developed that affords "the highest degree of separation to the greatest possible number of aircraft," Watts said.

- **Increasing use of radio handoff procedures.** Such handoffs in which an ATC center controller positively identifies a radar target before transferring it to an approach controller, are being recognized at 11 centers feeding 15 approach control facilities. On a part time basis, handoffs are made from 14 additional centers to 34 other approach control facilities. Jacksonville Center now is contracting for its radio equipment and soon will become the 30th center in the 45 others to use radar handoff including Alaska and Hawaii.

- **Establishing a National Flight Data Center.** This center, which FAA hopes will be operational by early 1962, will support a central flight information service formed to collect, evaluate and disseminate aeronautical data needed by government and the aviation community. The program, already under way, has resulted in joint coordination agreement on a format for a state low altitude, intermediate altitude and en route and departure charts. A common high-altitude en route chart also has been developed and its prototype will be distributed for evaluation within two months.

- **Strengthening en route holding and approach patterns** from those of piston-powered aircraft. This procedure has

been considered on computer at FAA's Atlantic City, N. J., test center with encouraging results. Low-level holding is to begin on Nov. 15 in the San Francisco, Denver and Atlanta terminal areas and further later dates. If this schedule, the modification studies, FAA intends to put its navigation pattern into effect wherever ATC volume regulations will permit it.

- **Supplying the Federal Aviation Administration with guidelines for strong limits to hour-bankability in the vicinity of airports.** Studies guidelines designed to plot when more complaints are most likely to develop will be forwarded to appropriate authorities. As recommended by earlier aviation studies, development of such data would be of value in zoning land bordering an airport and might otherwise the need for intensive particularity of the type-based symmetrical by state plans.

- **Developing improved Instrument Landing System (ILS) components.** To improve the effect of noise on ILS, FAA is working on two new types of localizer antennas (AWL, May 15, p. 91) and a new glide slope transmitter and localizer ILS antenna in general. Should these projects prove successful, and should the British Radar Landing System be made an integral part of U.S. ILS, the center's having of radar cables along the approach to an instrument runway may prove unnecessary.

In a report on when less advanced FAA projects, Thomas G. Linnart, head of ALPA's engineering and air

safety department, declared that the agency was recommending further to search on devices to improve weathered visibility in precipitation, instead of "tracer" perimeters to prevent the outbreak of low-level, a noticeable accident and better in flight loss warning.

Linnart also said that continuing weathered and "tracer" landing aids already have prompted the U.S. Weather Bureau to undertake a study of low-level weather behavior. ALPA has contended that "low-level jet streams" could be a cause of such accidents. Linnart said. As a result, the Weather Bureau plans to instrument four microwave and television towers to record wind data at lower levels between the ground and 150 ft in the vicinity of Washington National Airport. Reports of abnormal aircraft landings will be cross-checked with wind measurements at that airport. In addition, the agency has begun a long-range program aimed at developing a device that would sense and report a complete picture of weather immediately above an airport's runway, he said.

Runway Project

FAA's effort to develop a system of colored lights that would inform a pilot landing is taking off at the moment, after three runways were set on "active short-range project," Linnart reported. By the end of this year, he added, 57 runways will have RVR instrumentation. In 1962, 64 more will get RVR, in 1963, 93 others.

On the subject of fire fighting, Capt



Test Vehicle Simulates VTOL Aircraft

Manufactured last vehicle of Northrop Corp.'s Northrop, Hawthorne, Calif., said after the year, pitch and roll at a 40,000-lb. supersonic VTOL fighter in hovering attitude. The simulator was built so that studies could be conducted on the control power-control ability relationship for all weather vertical landing and island instrument flight.

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Cornell Aeronautical Laboratory has devised a new facility, the "Wave Superheater", which simulates, for approximately full-scale models, the extreme conditions of hypersonic flight. Temperatures of roughly 5000° K, suitable for research on many hypersonic problems, can be generated if the test gas is air, and approximately 17,000° K if the test gas is argon. Ten times of 13 seconds to speeds up to Mach 15 can be obtained as the continuously operating shock tube device. The large, 40-space-door test section permits simultaneous testing over a much greater range of air conditions than can be accomplished in any existing facility. Such computer testing gives the engineer a means of checking aerophysical and aerothermal assumptions.

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the earth's atmosphere. The space observatory will look
at ultraviolet light, map the sky's ultraviolet light and
perform other experiments to help scientists understand
how stars and nebulae are born.

IBM is developing an advanced memory system to go
along in this satellite and store its observations. The sys-
tem will receive instructions from the ground, help aim
the satellite's instruments and hold collected data for
periodic radio transmission back to earth.

The new space memory, being developed by IBM for
General Aircraft Engineering Corporation and the Gold-
standard Space Flight Center of the National Aeronautics
and Space Administration, called for some unusual solu-
tions from IBM engineers. For example, they were able
to reduce power demands considerably by designing the
memory to send out information over and over without
writing it back into memory each time. Another signifi-

cant accomplishment is the remarkable design reliability
of the new system, achieved through new techniques of
redundant circuitry.

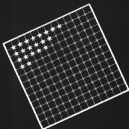
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Cost of Procurement

Successes and the number of U.S.A. industry leading and selling for 10-11 months. Division of Public Property at Hamilton in this field. Mr. Korte states:

"It is our intention to award approximately 15 contracts in the \$10,000-\$250,000 range on 14 priority. For each contract some 30 to 20 qualified companies will receive an invitation to bid proposals."

Most of 15 contracts are to be let with an average of 15 bidders each that amounts to 450 proposals. Assuming \$1,000 total sales per proposal (not high for proposals averaging \$100,000) the amounts in 52 million in contractor sales rate to answer the 75 contracts. At an average value of \$100,000 each the total value of the contracts would be \$2.5 billion.

There the companies will spend \$2.1 million to obtain 52 million worth of business. It is a miracle to assume these sales figures will come "out of pocket," since profit margin in procurement work never don't provide any "padding."

Mr. Korte is known to be both a highly professional engineer and a highly responsible manager and he can be relied on as a typical of a well managed government or research and development agency. If we only take the thousands of smaller efforts throughout NASA, DARPA, AFOSR, AFOSR and development agencies we are faced with wonder how little of the government research and development dollar actually finds its way into the laboratory.

I think we have created a procurement system which leads not to lost contracts but to money competition—money to the engineering procurement research in the corporations among the defense effort and money to the defense research and development effort itself. The money which has been effort to solve the defense development some concentration at the highest levels of our government.

ROBERT L. MARR
Cambridge, Mass.

West Ford Comments

The collapse of Project West Ford as not a great mistake, it is a rational proposal in the first place it was a national project. The United States has several needs, at considerable communication safety programs at Alaska, Guam, Cuba and the Pacific communication satellite programs. West Ford will not handle any of these needs by itself.

It will however, do distinct harm to other space programs. The funds poured into West Ford since 1959 and 1960 would be appreciably directed in collisions with the satellites. Also in danger is the delicate as fragile as metal communication in deep space and other parties. But worst of all is the black eye it gives to the nation's space program. The responsibility of this task is easily evident to most Americans and that the funds had such an American sense. I recall that a few years ago many Americans were worried about inadequate

American West Ford satellites the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, *Aviation Week*, 1300 W. Alameda St., New York 26, N.Y. To be kept for the next 300 words and give a positive identification. We will not print anonymous letters, but names of writers will be withheld on request.

and during Saturn space study. It is a rather disconcerting idea that we are the first to become involved. Our readers can also give the National the answer, to the issue changing facts this West Ford.

In the future we shall have to be more careful than ever in order to protect the world confidence in our "space" space program. I shall now personally that we have again deliberately used another newspaper.

FRANKLIN PETERSON
Lawrence, Kan.

Space Enthusiasm

I want to crash the moon! The reason I don't just come up with it is not a space program. After these things are said together to see a dream that most of them play such a major role in space exploration and actually spend money doing it. It is not to be said that, large scale exploration, large scale exploration and a standard of living that can support such an exploration plan in an engineering standard point that it is feasible, and not just wishful thinking.

I am an engineer and I get a great deal of my money out of putting something together and to find a really successful one in the way I have figured it out based on paper. It is a case of someplace that I am not at all sure of, much less than that I have searched for the same reason and space with a view further out even more so with respect and more in the earth. And so, the only thing is in the air? Are we possibly the starting of life in the Universe? If such things are in the minds of men, the earth nothing will stop us from exploring out. If this is so, let us hope that it will not need to be interrupted by our own little war.

Space competition can take the place of war as long as space exploration holds up. All the people of our country who have an interest in space can find their way to the big exploration team. We are all helping to pay for it. Also, the United States is the state and world and about the world and the only one to come out of the world as standard at least has advanced more than others in the state of the world. It is a shame to see the state of our technology, which has only occurred when a few hundred years compared with the known existence of man in thousands of years previous.

It is not to be denied that we have helped and accelerated the state of science technology under the support of self government, almost the whole world might also be considered government.

There may be some explanation of how to support the space effort of the country but

our country can support it. This lightening of both men, to entirely foreign because people will work harder and more people will also have a higher standard of living than if it were not happening. We would rather not have another war.

THOMAS J. PLESTER
Electronics Engineer
San Diego, Calif.

Helicopter Simplicity

See. Ministry of defense modernized military to a real operating outline of delivery by helicopter and to go "downside" down the helicopter can see the way for transport in the country.

Could we, some others, to improve the design of the aircraft industry, and particularly, the helicopter people (what the era is not a rough sketch) get a little encouragement in general simple proposals in order to make the project? Why, for example, do we not find that someone is being spent for electric helicopters to replace the helicopter design? Indispensable logic in helicopter rotor hubs (AW Mag 26 p. 39).

If the history of aircraft in the area of such sophisticated studies were exposed is a percentage of total aircraft research, a similar would be in many ways in fact in the Museum of Progress and Space will have it in the end.

WILLIAM H. KATZ, JR.
Stamford, Conn.

Moral Wisdom

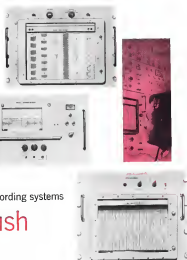
I read the letter by Mr. F. W. Korte (AW Sept. 18 p. 100) which contained an opinion in connection with the same. I have Mr. Korte's letter and it is not defendable against such well known, but I would like to comment the moral in question. Your editorial simply treated lightly and gently upon the helicopter field.

I, for one, do not wish the spectacle of a helicopter by German scientists in the country who take it upon themselves to offer public advice and control upon questions of society, ethics, theology and public well. If Mr. Korte and Mr. Korte to make a final one in regard and to wish to self-expression in a technical sense, why not let them say about in their area in the frame part to West?

These German scientists who came to this country about 1944 were at first given as a period of cultural freedom, particularly by the German people and the public is placed although not until German culture is clear out of it.

The technical wisdom they brought the V-2 and V-3 and it was not to pay their tribute to our military establishment, but we who do not wish the association need not acknowledge this gift to be indelible as moral and moral and moral and moral.

DONALD BRADY
Engineer, waste industry
Elmer City, Calif.



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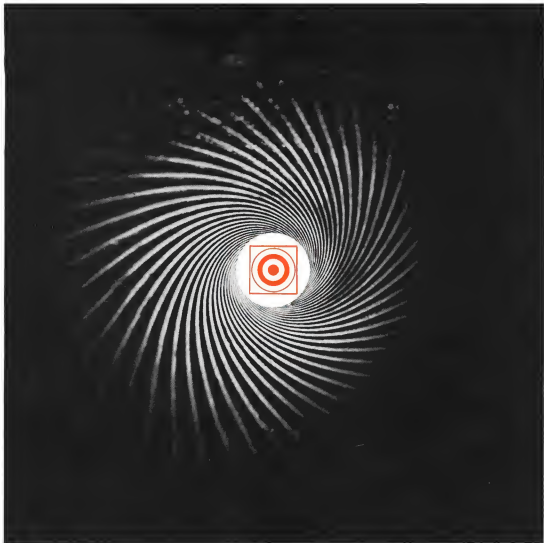
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